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RECONNAISSANCE OF MINING DISTRICTS IN PERSHING COUNTY, NEV.

BY

WILLIAM O. VANDERBURG

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RECONNAISSANCE OF MINING DISTRICTS IN PERSHING COUNTY, NEV.[1]

By William O. Vanderburg[2]

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INTRODUCTION

This paper gives the results of a reconnaissance of the mining districts in Pershing County, Nev., made from March 9 to April 1, 1936. During the field work nearly all of the mining districts in the county were visited, and considerable data were obtained on active and inactive properties. The report covers the location of the various mining districts, nature of the deposits, information on past

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2/ Mining engineer, U. S. Bureau of Mines.

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operations and current activity, and general data likely to be useful to operators, investors, and others interested in mining. The geology of the deposits is discussed only briefly.

Many mining districts in the county have been active intermittently for 20 to 75 years and have experienced alternate periods of prosperity and decline. In past years numerous small mills have been built to treat ores in this area; many of these were unsuccessful owing either to scarcity of ore in the property for which the mill was erected or to poorly designed flow sheets. Custom milling or smelting plants have been erected from time to time to serve the various mining districts, but when the ore supply was exhausted these plants were dismantled.

Current metal-mining activity in Pershing County is characterized by a number of small-scale operations by lessees or owners. The ores are shipped mainly to smelters near Salt Lake City, Utah, for treatment.

ACKNOWLEDGMENTS

Thanks are due the many owners and operators in the county, all of whom wholeheartedly furnished information and assistance. The author is especially indebted to Ott F. Heizer, general manager of the Nevada-Massachusetts Co., Inc., and John T. Reid, mining engineer at Lovelock, Nev., for data on some of the mining districts mentioned in the report.

PERSHING COUNTY

General

Pershing County, in northwestern Nevada, was created out of the southern part of Humboldt County, and the boundaries were established by an act of the State legislature, approved March 18, 1919. This county was the last of the 17 counties of the State to be created. It has a land area of 6,053 square miles and a water area of 60 square miles, a total of 6,113 square miles. The water area comprises the eastern half of Winnemucca Lake on the Washoe-Pershing County boundary line. Figure 1 is a sketch map of the county.

According to the census of 1930 the population of the county was 2,652, about half of whom reside in Lovelock, the county seat. Lovelock, the principal town, is the center of an area devoted to stock raising, agriculture, and mining.

The assessed value of property for the fiscal year 1934-35 was $11,459,538.25. The county tax rate for that year was $1.48 per $100 exclusive of special taxes.3/

Physical Features

The physical features of Pershing County comprise a series of parallel mountain ranges striking north and south and separated by troughlike valleys. The alternation of mountains and valleys forms a series of basins that result in a unique hydrography; the receptacles of the drainage waters become, depending on

3/ Parke, W. W., Annual Report of the Auditor of the County of Pershing, State of Nevada, Fiscal Year July 1, 1934 to June 30, 1935, p. 13.

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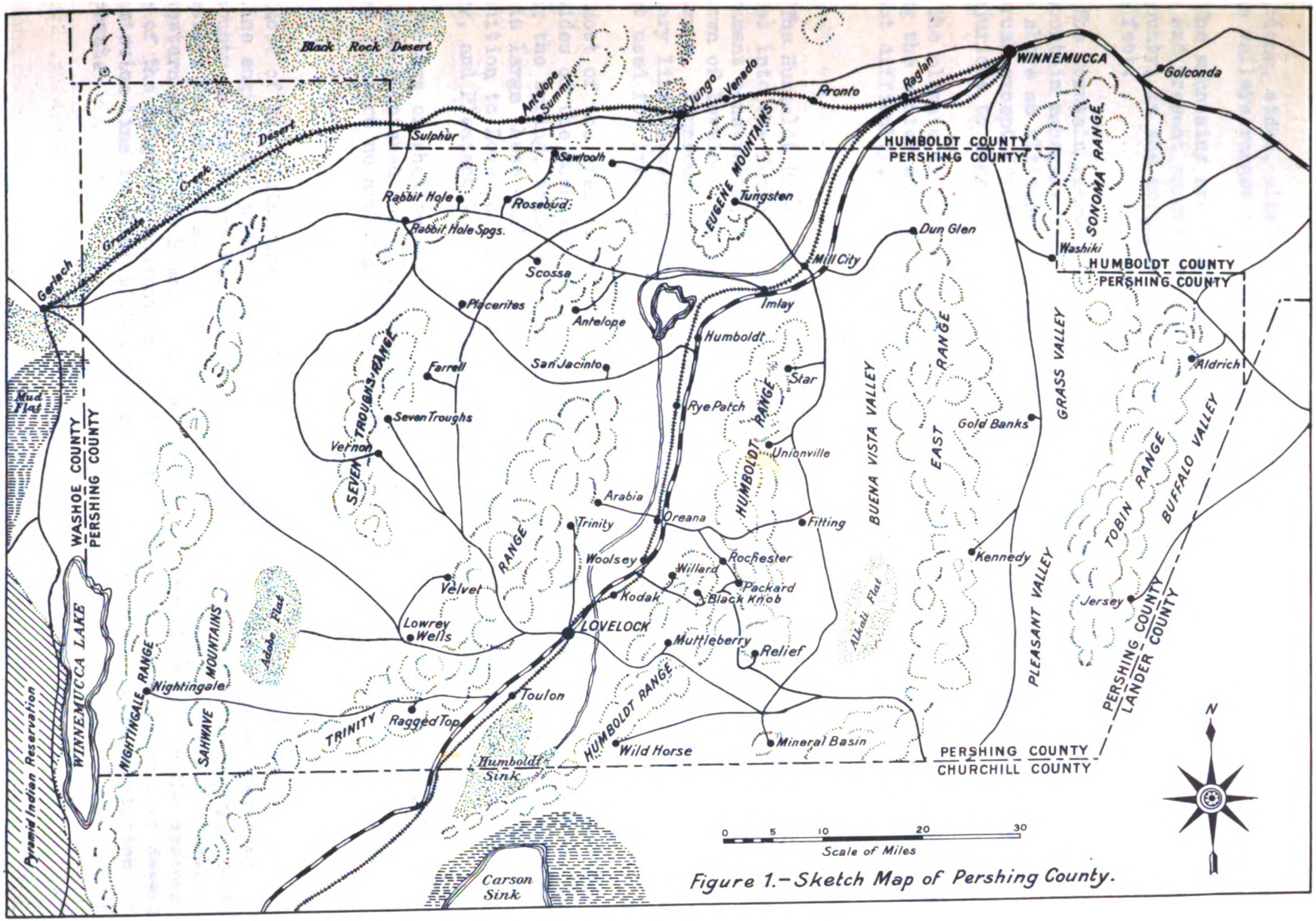

Figure 1.—Sketch Map of Pershing County.

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conditions, sinks, alkali flats, or salt beds. The altitude of the lowest parts of the valleys ranges from 4,000 to 4,500 feet above sea level.

The mountains are less rugged and precipitous than in other parts of the State and present smooth, rounded outlines. Star Peak, the highest mountain in the county, in the northern part of the Humboldt Range, has an elevation of 9,835 feet.

The mountain ranges have virtually none of the stunted pinon pine, juniper, and mountain mahogany that are usually prevalent on the mountain ranges of the State above an altitude of about 7,000 feet. The lower areas are covered with sagebrush except for the parts of the valleys that have an alkaline soil which is injurious to vegetation.

The climate is mild and healthful with scanty rainfall. A little snow falls during the winter months, but mining operations can be carried on the year round without difficulty.

Water Resources

The Humboldt River, the largest and longest stream in Nevada, normally empties into the Humboldt sink in southwest Pershing County. In 1935 the Federal Government constructed an earth dam at Rye Patch to irrigate Lovelock Valley. The town of Lovelock depends largely on the waters of the Humboldt River for its existence. Winnemucca Lake is a long, narrow body of alkaline water on the boundary line between Pershing and Washoe Counties. The water of Winnemucca Lake is not used for irrigation or other purposes.

Most of the precipitation is in the form of snow during the winter months. The sides of the mountain ranges are traversed by numerous canyons in which, during the spring, small streams are formed by melting snow. Where the drainage area is large these small mountain streams contain enough water for irrigation. In addition to Lovelock Valley ranching is carried on in Buena Vista, Grass Valley, and Pleasant Valley in the eastern part of the county.

Springs or shallow wells are distributed throughout the area, and frequently they have furnished enough water for milling and domestic uses. As far as the writer is aware no artesian wells have been sunk.

Power Facilities

Most of the mining areas in Pershing County depend on either Diesel or gasoline engines for power. The only public service power company operating in the county is the Sierra Pacific Power Co., which serves Lovelock Valley, and the Rochester, Relief, and Mill City districts. The main transmission line parallels the western side of the Humboldt Range, and the mining districts on the western slope of the range are convenient to the power line. The average cost of desert transmission line is about $1,200 per mile, including good, used, substation equipment.

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The rates for wholesale low-voltage power service under Schedule K of the Sierra Pacific Power Co., applicable where less than 2,200 volts are furnished, is as follows:

Demand charge of $2.40 per month per kilowatt of maximum demand, plus an increase of 1 percent for each 1 percent that the average power factor falls below 80 percent. The maximum demand on which the demand charge will be based will not be less than 50 percent of the greatest maximum demand occurring during the 11 preceding months.

Plus a kilowatt-hour charge of:

	Cents per kw.-hr.
First 3,000 kw-hr. per month.....	1.6
Next 3,000 kw-hr. per month.....	1.4
Next 3,000 kw-hr. per month.....	1.2
Next 3,000 kw-hr. per month.....	1.0
All over 12,000 kw-hr. per month.....	.8

Discount of 20 cents per kilowatt of demand will be allowed when payment is made within 10 days from the date bill is rendered.

Transformers to be furnished by company or customer at the option of the company.

The rate for high-voltage power applicable where service is furnished at 2,200 volts or over is figured on the same basis as for low-voltage power, with one of the following discounts:

(a) Discount of 10 percent will be allowed where the company furnishes power at 60,000, 22,000, or 13,000 volts and meters at its option on either the low-tension or high-tension side of the transformers.

(b) Discount of 5 percent will be allowed where the company furnished power and meters at 2,200 volts or 4,000 volts and customer owns distribution transformers.

(c) Discount of 2½ percent will be allowed where the company furnished power and meters at 2,200 volts or 4,000 volts and company owns distribution transformers.

(d) Discount of 2½ percent will be allowed where the company furnishes power at 2,200 volts or 4,000 volts and meters at 110 volts or 220 volts or 440 volts and customer owns distribution transformers.

The maximum demand for any one month shall be the average total load in kilowatts in that 15-minute interval in which consumption of electric energy is greater than in any other similar interval during the month.

Term of contract not less than 1 year.

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Where a consumer notifies the company in writing that he will not require service for a period of 60 days or more from and after a certain date when the discontinuance of the use of power is due to climatic conditions preventing operations by the consumer, said notice to be mailed or otherwise delivered to the company at least 15 days prior to the date when it is desired to discontinue operations and does not demand service from the company for such a period, the company will disconnect the service and waive the minimum charge in effect for the period during which the service is disconnected. When the consumer resumes service, if at all, the maximum demand on which the demand charge for any month will be based will not be less than 50 percent of the maximum demand occurring during the 11 months preceding the month for which billing is made, excluding the months during which service is not used. This rule applies only to power used for mining and for the milling and reduction of ores.

Transportation Facilities

The Southern Pacific Railroad traverses the county northeast-southwest, following the course of the Humboldt River. The Western Pacific Railroad passes through the northwestern part of the county. There are no branch-line railroads.

The Transcontinental Victory Highway parallels the Southern Pacific Railroad. All the districts mentioned in this report are accessible by fair dirt or gravel roads on which automobiles can travel 20 to 30 miles per hour.

The Southern Pacific Railroad freight rates on ores from Lovelock, Kodak, and Woolsey to Utah smelters are shown in the following table:

Value of ore per ton	$15	$20	$30	$40	$50	$60	$70	$80
40-ton car.....	3.20	3.90	4.60	5.30	6.00	6.70	7.40	8.10
20-ton car.....	5.10	5.80	6.50	7.10	7.60	8.10	8.60	9.10
Value of ore per ton	$90	$100	$150	$200	$250			
40-ton car.....	8.80	9.50	11.20	11.50	13.40			
20-ton car.....	9.60	10.30	11.20	11.50	13.40			

A 10-percent surtax also is effective until June 30, 1936.

The rates to Utah smelters from Oreana, Mill City, and Bennin are the same on ores valued up to $90 per ton. Above that value the rates are a little less than those stated.

The Western Pacific Railroad freight rates from Sulphur, Antelope, Jungo, Venado, Gaskell, Pronto, Raglan, Crum, and Winnemucca to Salt Lake smelters are as follows:

Value of ore per ton	$10	$15	$20	$30	$40	$50	$60	$70
40-ton car.....	4.00	4.00	5.00	5.50	6.00	6.50	7.00	7.50
20-ton car.....	3.20	3.20	3.20	3.90	4.60	4.75	5.25	6.00
Value of ore per ton	$80	$90	$100	$110	$120	$130	$150	
40-ton car.....	8.00	8.50	8.85	....	....	....	....	
20-ton car.....	6.75	7.50	8.25	9.10	9.35	9.60	10.35	
Value of ore per ton	$200	$250	$300					
20-ton car.....	10.80	12.20	12.60					

Rates to Selby smelter in California are practically the same.

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History of Mining

Mining activity in the area covered by this report began about 1860 with the organization of the Humboldt mining district. In 1861 the Star and Buena Vista districts were discovered, and the town of Unionville became the center of mining activity in the region. During the decade following the Civil War a number of mining districts were organized, thousands of locations made, towns built, and large sums of money expended in mining. Abundant evidences of this early activity remain in numerous prospect holes in the Humboldt Range. The writer believes that the Humboldt Range has been prospected more thoroughly than any other mountain range in Nevada. Several Stetefeldt furnaces were erected, one at Oreana and one at Winnemucca, to treat the base ores. The Oreana smelter was the first in Nevada from which lead was shipped in commercial quantities, and it contests with Argenta, Mont., the honor of being the birthplace of the silver-lead smelting industry in the United States. In addition to these smelters numerous 5- to 10-stamp mills were erected in the sixties and seventies in the Buena Vista, Sierra, and other districts of the region. Most of these early mines reached the zenith of their production before the first railroad was completed.

The Central Pacific Railroad (now Southern Pacific Railroad) was completed across the State on May 10, 1869, and prior to this date supplies and machinery had to be hauled by wagon team from Marysville or Sacramento, Calif. Railroad communication did not improve mining facilities sufficiently to offset the decrease in the grade of the ore so that mining gradually declined in the older districts.

Before completion of the railroad considerable quantities of high-grade ores were packed by wagon train to the coast. Some of these ores were shipped to Swansea, Wales, for smelting. Even after the railroad was completed some ore was transported by rail to the coast and then shipped to England via Liverpool. According to Whitehill[4/] ores were shipped to England as ballast in sailing vessels so that the cost of freight from mines to England was only $35 per ton.

From 1881 to 1900 the gold placers discovered in American Canyon, Spring Valley, and Dry Gulch in the eastern part of the Humboldt Range and the placers in the East Range attained considerable prominence and were actively worked by American and Chinese miners.

Important discoveries at Seven Troughs in 1907 and at Rochester in 1912 revived mining activity for a number of years.

In recent years the mining of tungsten ores has been the outstanding development in the mineral industries of Pershing County. At present precious-metal mining in Pershing County is confined largely to small-scale operations either by lessees or owners.

Metal Production

Pershing County is distinguished for the variety of its mineral resources. The principal minerals produced in the past have been silver, gold (both lode and placer), tungsten, and quicksilver. In recent years the principal output of the county has been tungsten concentrates from the Mill City deposits. Table 1 shows the production of the principal metals exclusive of tungsten and quicksilver.

Other minerals that have been produced in commercial quantities are antimony, arsenic, sulphur, copper, lead, dumortierite, diatomaceous earth, gypsum, and small quantities of iron and zinc.

In March 1936 the writer estimates that 340 men were employed directly in the mining industries of the county.

4/ Whitehill, H. R., State mineralogist, Biennial Report of State Mineralogist, State of Nevada, 1871-72, p. 49.

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TABLE 1. - Metal production Pershing County, 1919-34

Year	Lode gold		Placer gold		Silver, lode and placer	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
1919	7,143.87	$147,677	45.72	$945	706,734	$791,542
1920	6,916.76	142,982	3.43	71	653,669	712,499
1921	9,384.17	193,988	4.21	87	739,975	739,975
1922	5,450.60	112,674	17.27	357	836,199	836,199
1923	6,412.01	132,548	49.68	1,027	731,222	599,602
1924	6,031.59	124,684	99.75	2,062	352,168	235,953
1925	1,743.78	36,047	41.84	865	71,978	49,953
1926	629.07	13,004	46.34	958	20,643	12,881
1927	2,366.41	48,918	63.90	1,321	168,327	95,441
1928	2,037.41	42,117	48.33	999	252,881	147,935
1929	516.88	10,685	149.40	3,088	55,944	29,818
1930	10,836.63	224,013	71.84	1,485	24,514	9,438
1931	6,398.56	132,270	184.41	3,812	14,113	4,093
1932	1,622.43	33,539	214.61	4,436	13,228	3,730
1933	3,848.49	79,555	492.74	17,186	28,023	9,808
1934	9,904.11	346,149	557.15	19,472	53,939	34,870
Total	81,242.77	1,820,850	2,090.62	58,171	4,723,557	4,313,737

Year	Copper		Lead		
	Pounds	Value	Pounds	Value	Total value
1919.....	186,025	$34,601	21,578	$1,144	$975,909
1920.....	3,751	690	101,298	8,104	864,346
1921.....	1,020	132	82,928	3,732	937,914
1922.....	6,726	908	96,801	5,324	955,462
1923.....	210	31	48,549	3,398	736,606
1924.....	2,196	288	32,815	2,625	365,612
1925.....	1,981	281	99,977	8,698	95,844
1926.....	4,245	594	215,995	17,280	44,717
1927.....	552	72	96,972	6,109	151,861
1928.....	5,314	765	77,269	4,482	196,298
1929.....	27,975	4,924	36,102	2,274	50,789
1930.....	33,357	4,337	36,032	1,802	241,075
1931.....	2,220	202	11,520	426	140,803
1932.....	2,888	182	605	18	41,905
1933.....	.....	.....	22,980	850	107,399
1934.....	3,853	308	35,838	1,326	402,125
Total.	282,313	48,315	1,017,259	$67,592	$6,308,665

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Aldrich (Iron Hat) District

The Aldrich or Iron Hat district is on the east slope of the Tobin Range 22 miles southwest of Valmy, a station on the Southern Pacific Railroad.

Several carloads of lead-silver ore averaging $38.90 per ton were shipped by the Iron Hat Corporation in 1910. A few years ago eight unpatented claims were acquired by the Consolidated Mines Corporation of America. This company drove a crosscut tunnel about 1,800 feet long which exposed two veins at depth. About 800 feet of drifts were extended on the two veins, but only 1 car of ore was produced; it is reported to have averaged $32 per ton (42 ounces of silver at 32 cents per ounce, remainder lead at 3 cents per pound). All mining machinery has been removed from the property.

The formation is limestone, and the veins are of the replacement type. Values are in lead and silver. Veins average about 3 feet in width and dip 60°.

Antelope (Cedar) District

The Antelope or Cedar district is in the Antelope Range 18 miles west of Imlay, Nev., by automobile road. Mining activity was begun in this area in 1905. The Nevada Superior Mines Co. shipped ore to smelters from 1906 to 1911, when the company erected a 75-ton gravity-concentration mill that operated until 1913. The adjoining property, the Antelope Spring Mining Co., built a 25-ton gravity-concentration plant in 1915 that was enlarged to a 50-ton flotation plant in 1917. The Majuba Copper mine located by A. J. McCaulay in 1907 was sold to the Mason Valley Mines Co. in 1914. During the war the Mason Valley Mines Co. shipped 4,000 tons of 12-percent copper ore to its smelter in Mason Valley and did considerable development work. In 1920 the Last Chance property was acquired by a group from Fresno, Calif., that organized the Majuba-Fresno Silver Mines Co. In 1935 the property was taken over by Detroit interests. In March 1936 this company and the Nevada Superior Mines Co. were the only active properties in the district.

The Last Chance property comprises a group of 10 unpatented claims. Development work consists of a tunnel 830 feet long and a shaft 100 feet deep with levels at 40- and 100-foot elevations; total development work comprises 1,600 feet.

The principal rocks exposed on the Last Chance claims are shale and porphyry. Three veins are exposed in the tunnel. The veins average 4 feet in width and dip about 60°. Most of the ore is stained with manganese and iron oxides.

From 1906 to 1928 lessees are reported to have shipped 1,000 tons of ore from this property, averaging 40 ounces of silver per ton and 8 percent lead. A shipment of ore from this property made by A. J. McCauley to the U. S. Smelting, Refining & Mining Co. on July 21, 1928, furnished the following information:

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Metal quotations:

Ag - - - per ounce	$0.58875
Pb - - - per pound	0.248

Settlement assay:

Au - - - oz.	0.0175
Ag - - - do.	74.8
Cu - - - percent	.1
Insoluble - do.	21.6
Fe - - - do.	24.25
Zn - - - do.	1.9
S - - - do.	1.05
Pb - - - do.	20.0

Value per ton:

Ag	$41.84
Pb	16.37
	58.21
	4.44
Net value per ton	53.77

Treatment	$3.74
Insoluble (penalty)	2.16
	5.90
Fe (premium)	1.46
	4.44

Weight:

Wet ore - pounds	16,860
Moisture, 1.4 percent - pounds	236
Dry ore - pounds	16,624
dry tons	8.312

8.312 tons at $53.77 per ton		446.94
Freight, $8.50 per ton	$71.66	
Assay	5.00	
Handling charge	3.00	
	79.66	79.66
Net proceeds		367.28

It is reported that there are 5,200 tons of ore on the mine dump that average 17 ounces of silver per ton and 8 percent lead.

In March 1936 six men, under the supervision of Thomas Varley of Imlay, were employed in rehabilitating the mine. The cost of equipping the mine when operations were begun was as follows:

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Headframe (22 feet high)		$296.00
Timber	$107.00	
Steel rods, bolts, etc.	19.00	
Ore bin	20.00	
Labor	150.00	
	296.00	
Sheave wheel (24 inches) and bearings (used)		18.00
Cable, 300 feet, 5/8 inch diameter		55.00
Compressor and engine (used)		500.00
Drill, steel and bits		320.00
Hoist		80.00
Pneumatic "sponge pump"		250.00
Total		1,519.00

This equipment includes a compressor of 240 cubic feet capacity, belt-connected to a truck engine; a single-drum hoist direct-connected to 6-horsepower gasoline engine; and a combination sinker and Leyner drill. Detachable drill bits with 1-inch hexagonal steel are used in drilling. The bits cost 32 cents each, and three sizes are used - 7/8 inch, 2 inches, and 2 1/8 inches. Bits are sharpened at the Utah Apex mine in Utah for 8 to 10 cents each, depending on quantity.

A flow of water in the shaft averaging 28 gallons per minute is pumped with a pneumatic sponge pump. This type of pump is a recent innovation in mine-drainage equipment. It is a 2½-inch by 6-inch single-stage centrifugal pump, operated by a rotary-air motor equipped with a governor and variable speed control. Air consumption is 100 cubic feet per minute at 70 to 100 pounds pressure, and the maximum lift is 125 feet. The capacity is 100 gallons of water per minute under a total head of 85 feet. At the bottom is a perforated steel screen with 9/16 inch diameter holes, and the pump will handle gravel that will pass through this opening. It will work submerged and will also handle water when the suction end is not completely in water. The over-all length of the pump is 28 inches, and it will pass through an opening 13 by 9 inches in section. The weight of the pump is 85 pounds.

The Majuba Copper mine, comprising three patented claims owned by New York interests, is on the west slope of Majuba Mountain. It is developed by three tunnels; the lowest tunnel is reported to be 2,040 feet in length, the middle tunnel about 500 feet, and the uppermost tunnel about 100 feet, and there are some subsidiary workings. All mining equipment has been removed from the property except the tramway about 1,000 feet long from the middle tunnel to the ore bin. The property was last worked in 1928 by A. J. McCauley of Imlay, who shipped 2 cars of ore averaging 14 percent copper.

The country rock is a tourmalinized rhyolite. The copper minerals in the ore are chalcocite, cuprite, and chrysocolla. Arsenopyrite, tourmaline, and fluorite are present. An interesting feature of the property is the shoot of tin ore that occurs along the fissure containing the copper ore. The cassiterite occurs in tourmalinized rhyolite associated with tourmaline and quartz. Small masses of extremely rich cassiterite ore have been found, but unfortunately not in commercial quantities.

The Nevada Superior Mines Co., E. R. Reitsch, president, 482 North Main Street, Rockford, Ill., owns two claims and a fraction of patented ground 4 miles northwest of the Majuba Copper mine. Development work consists of an inclined shaft 350 feet

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deep and an adit 2,000 feet long. Silver-lead ore occurs in limestone near a schist contact. After being idle for many years the property has recently been taken over by E. J. Baker of Lovelock, under bond and lease. Smelter returns from a shipment of ore made by Baker to the International Smelting & Refining Co. on December 17, 1935, furnished the following information:

Metal quotation:

Lead - - - per pound	$0.045
Silver - - per ounce	.70

Settlement assay:

Au - - - ounce	0.01
Ag - - - do.	57.24
Cu - - - percent	.3
Pb - - - do.	33.1
Zn - - - do.	1.9
Insoluble do.	23.4
Fe - - - do.	15.5
S - - - do.	1.1
Lime - - do.	.2

Metal payments:

Pb - - - 90 percent at $0.02975	$17.725	
Ag - - - 95 percent at $0.77 per oz.	41.871	
Gross metal payment		59.596
Less treatment		3.60
Net value per ton		55.996

Treatment-charge base	$ 2.50	
Credit Pb over 30 percent of $0.10	.31	
	2.19	
Penalty for insoluble at $0.10	2.34	
	4.53	
Premium iron at $0.06	.93	
Net treatment charge		3.60

Net weight ..... pounds		22,220
Less moisture 2.62 percent do.		582
Dry weight ..... do.		21,638
tons		10.819

10.819 tons at $55.996 per ton	$605.82	
Royalty 10% of $570.30	$57.03	
Freight	35.52	
	92.55	92.55
Net proceeds		$513.27

The Antelope mine near the property of the Nevada Superior Mines Co. has been idle about 25 years.

About 1/2 mile from the Majuba Copper mine is an arsenic deposit owned by N. Adamson, of Reno, that consists of one unpatented claim. It was last worked during the World War by E. S. Chafey, who shipped some ore.

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Arabia District

The Arabia district is in the east foothills of the Trinity Range about 5 miles west of Oreana, a station on the Southern Pacific Railroad. It was discovered by George Lovelock in 1859 and became active in the sixties. A Stetefeldt furnace was built on the Humboldt River at old Oreana to treat the ores of the Montezuma mine in 1867. This smelter has the distinction of being one of the first lead smelters in the United States. It was erected after unsuccessful attempts had been made to reduce the ore in stamp mills.

The Montezuma mine has been the principal producer of the district. Statistics on production are fragmentary. In 1868 Raymond[5/] estimated that the Montezuma mine had produced 1,500 tons of ore and that ore reserves were 1,200 tons. The ore contained 40 to 50 percent lead and antimony and 60 to 80 ounces of silver per ton. From 1916 to 1918 the slag dumped from former smelting operations was shipped to the Midvale smelter to recover the lead, antimony, and silver contained in it.

From 1919 to 1930 a small quantity of ore was produced annually by lessees and owners. The tonnages produced and average values per ton for some typical years, according to Mineral Resources, are as follows:

Year	Tons	Value	Value per ton
1921	164	$10,312	$62.88
1923	110	5,425	49.32
1925	213	11,064	51.94
1926	323	14,194	43.94
1927	200	8,607	43.04

The ore contained lead, silver, gold, copper, and antimony. In March 1936 the district was deserted and all mining equipment had been removed.

The geology of the district has been described by Knopf.[6/] The principal rock is granodiorite which contains contact-metamorphosed sedimentary rocks of the hornfels type. The granodiorite and hornfels are cut by numerous veins carrying silver-bearing bindheimite, the so-called hydrous antimonate of lead. Some veins can be traced on the surface for more than 1,000 feet.

The main working of the Montezuma mine consists of a large open-cut about 100 feet long, 20 feet wide, and about 25 feet deep. In the early days an inclined shaft was sunk 120 feet on the vein beginning at the open-cut, but it is reported to have passed out of ore at a depth of 60 feet.

About 1/4 mile north of the Montezuma mine considerable work has been done on the Electric vein. The vein ranges in width from 1 to 3 feet. A group of 10 patented claims is owned by Electrical Mining & Reduction Co., Newton, Mass.

Total workings in the area are 3,500 feet, and deepest shaft reaches a vertical depth of 210 feet.

5/ Raymond, R. W., Mineral Resources of the States and Territories West of the Rocky Mountains for 1868: 1869, pp. 130-131.

6/ Knopf, A., The Antimonial Silver-Lead Veins of the Arabia District, Nevada: U. S. Geol. Survey Bull. 660, 1918, pp. 240-255.

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Black Knob District

The Black Knob district is several miles southwest of Black Knob Peak in the Humboldt Range, about 12 miles by automobile road west of Kodak, a station on the Southern Pacific Railroad.

The principal property is the Sutherland antimony mine comprising three unpatented claims owned by the Texas Mining & Smelting Co. of Laredo, Tex. In the early days a small furnace was erected at the mine to treat the ore, but this venture was unsuccessful. The property was last worked during 1916 and 1917. The mine has produced more antimony than any other mine in Nevada. During the World War production is estimated to have been about 4,500 tons of ore averaging about 35 percent metallic antimony. Some ore produced during the war was concentrated in a small mill on the Humboldt River using Joplin-type jigs. The ore was shipped mainly to the Nicholas-Layng Chemical Co. of San Francisco for smelting. Except for the annual assessment work, the property has been idle since 1917.

The mine is developed by a vertical shaft 210 feet deep and some lateral workings. The antimony veins occur in calcareous shale near rhyolite flows. The ore minerals consist of stibnite and a little antimony oxides.

Farrell (Stonehouse) District

The Farrell or Stonehouse district is on the east slope of the Seven Troughs Range, 31 miles by automobile road northwest of Lovelock. It is sometimes considered part of the Seven Troughs district which adjoins it on the north. The first discovery in this area was made by L. H. Egbert in 1863. Interest in the district was revived in 1907 by the activity at Seven Troughs. Rich float carrying gold was found, and considerable prospecting was done, but no prominent mines were discovered. According to G. W. Warmoth of Lovelock, who has been familiar with activity in this area for many years, the total production has been valued at approximately $50,000, and nearly all of it was shipping ore.

At Farrell the principal property comprises nine unpatented claims owned by Mrs. M. E. Devaney. This property has been developed by an adit several hundred feet long and an inclined shaft 200 feet deep. In 1935 the Devaney property was leased to A. H. Rogers for a royalty payment of 10 percent of the values recovered. Rogers erected a small mill in which about 200 tons of ore from the Devaney property were treated. Mill equipment consists of a small ore bin, a Challenge feeder, a 5-stamp battery (550-pound stamps), a 4- by 10-foot silver-plated amalgamating plate, and a small concentrating table. Power for milling is supplied by a 10-hp. Fairbanks-Morse Z-type gasoline engine. Water for milling is available from the inclined shaft on the property. It is reported that milling operations were handicapped because of an inadequate supply of water. In March 1936 the mill was idle, and the owner was planning to move it to Vernon in the Seven Troughs district to handle custom ore.

The ore on the Devaney ground occurs in seams and lenses in rhyolite. The vein material carries considerable green fluorite mixed with quartz and altered rhyolite. The values are chiefly gold and some silver.

G. W. Warmoth owns four unpatented claims and a bond and lease on the Monarch group of four patented claims 2 miles north of Farrell. In 1929 the Seven Troughs

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Extension Co. worked the Warmoth holdings under bond-and-lease agreement. The company erected a 50-ton flotation plant in 1930. The mill did not operate satisfactorily, and flotation was superseded by amalgamation. After about 1,500 tons of ore were treated mostly from mine dumps, the mill was sold at a sheriff's sale. Production from milling operations totaled $6,000. In 1935 the property was worked by Warmoth and a partner who produced 1 carload of ore. Returns from this ore which was shipped to the American Smelting & Refining Co. on January 9, 1936 were as follows:

Metal quotation:			
Au -		$34.9125	
Ag -		.77	
Settlement assay:			
Au - oz		.655	
Ag - do		4.05	
Metal payment			
Au at $31.81825		20.84	
Ag less 0.5 oz		2.73	
		23.57	
Less treatment charge		4.11	
		19.46	
Wet weight - lb	40,660		
Less 6.2 percent H_2O - lb	2,520		
Net weight - lb	38,140		
tons		19.07	
19.07 tons at $19.46			$371.10
Deductions:			
Freight advanced at $5.10 per ton		103.68	
Emergency freight 7 percent		7.26	
Diversion		5.85	
Emergency freight 10 percent		.59	
		117.38	117.38
Net proceeds			253.72

The haul to Lovelock 35 miles away cost $4 per ton.

Other properties in this area have produced small quantities of shipping ore, but in March 1936 there was little activity.

Gold Banks District

The Gold Banks district is 38 miles south of Winnemucca on the east slope of the Sonoma Range a short distance south of the low divide separating Grass Valley and Pleasant Valley. It was discovered by A. P. Smith in 1907. Shortly after its discovery lessees prospected the veins for shipping ore with little success. According to A. B. Anderson, who is familiar with activity in the district since its discovery, the total production of shipping ore has been three carloads averaging about $25 per ton. There never has been a mill in this area.

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Two parallel veins striking nearly north and south and dipping about 50° west are traceable on the surface for several thousand feet. The veins have been explored by a number of shallow shafts. The formation is rhyolite, and the veins average 4 to 6 feet wide. Vein filling is predominantly a hard, iron-stained quartz with fragments of country rock. Values are in gold and silver. Development work comprises several thousand feet of shafts and drifts. All dumps show considerable quartz. When the writer visited the district the only activity was assessment work being done by A. B. Anderson, who owns eight claims on the north end of the district. The main workings are on four claims owned by H. J. Murrish of Lovelock. Water is available in a well 35 feet deep, located 1/4 mile east.

A vein was discovered by Ed Amonett and James Frank in 1933 several miles north of Gold Banks and about 1½ miles west of Mud Springs Ranch. It is a quartz vein 2 to 4 feet wide, and geologic conditions are essentially the same as at Gold Banks. This vein has been prospected by an 80-foot shaft, several short tunnels, and some lateral workings totaling about 500 feet. It is reported that one carload of gold-silver ore was shipped in 1934 from the Amonett and Frank claims. In March 1936 the property was idle. The equipment on the property comprises a 6- by 6-inch compressor, belt-driven by an automobile engine, and a blacksmith shop.

The Gold Banks Mercury mine is 4 miles west of the Gold Banks district. Some development work was done in 1913 and a 10-pipe retort furnace built which, with a D-retort, was operated the following year. In 1915 a 50-ton Herreshoff furnace was erected which operated until 1917, when it was put out of commission by fire. Prospecting and development work continued until 1919. In March 1936 the property was idle.

The ore is cinnabar which occurs in small stringers and disseminations in a hard, quartzitic rock. The principal ore body was an irregular mass about 350 feet long, 100 feet wide, and 20 feet thick. This was mined by open-cut method.

Haystack District

The Haystack district is near Haystack Butte in north Pershing County 22 miles northwest of Imlay by automobile road. Jungo, a station on the Western Pacific Railroad, is 7 miles north.

The principal property is the Lone Star which consists of five unpatented claims owned by George B. Austin of Jungo. Several miles from the Lone Star mine a 5-stamp mill was erected in 1915 and operated for a short time. In 1933 George B. Austin shipped 59 tons of ore to a Utah smelter, which netted him $950.87. Total production from the district has been small.

In March 1936 the Lone Star property was under lease to Raymond G. Taylor. It has been prospected by several shallow shafts and some lateral workings which total less than 1,000 feet, the deepest shaft being 50 feet.

Quartz veins occur in granite. Veins range from 1 to 3 feet in width and dip 30 to 60°. Values are chiefly gold, with some silver.

Gold ore was discovered in 1935 by Otto Jancke on Alpha Mountain 6 miles east of the Lone Star property on patented railroad land in sec. 11, T. 34 N., R. 32 E.

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Otto Jancke and O. C. Miller were prospecting on a 40-acre tract leased from the Southern Pacific Railroad in 1936. Prospecting work consisted of a number of open-cuts, none of which was more than 15 feet below the surface at any point.

When the writer visited the property four parallel veins striking east and west and dipping 55° south had been found. The veins average 10 inches in width; the country rock is granodiorite, and the vein filling is chiefly quartz carrying free gold. In places, on either or both walls of the veins, seams of arsenopyrite 1 to 2 inches wide carry values in gold up to $70 per ton. The average value of the vein material is $25 per ton, as determined from an 800-pound sample treated at the Olsen mill at Scossa. No ore had been shipped up to March 1936.

The nearest water is in Woody Canyon on the west slope of the Eugene Mountain 7 miles away.

James Walker of Lovelock has located five claims on public land about 1 mile east of the Jancke lease. These claims are in the prospecting stage.

Humboldt (Imlay, Eldorado) District

The Humboldt, Imlay, or Eldorado district is at the north end of the Humboldt Range on its west flank. From north to south it includes Prince Royal, Humboldt, Florida, Black, and Eldorado Canyons. Humboldt, a station on the Southern Pacific Railroad, is several miles east. The Humboldt mining district was organized in 1860, and Humboldt City was founded and had a population of 500 in 1863.

The Imlay mine worked in the early days has been the principal mine in this area. In 1907 it was equipped with a 10-stamp amalgamation-concentration mill. This mill operated at intervals until 1918. Judging from the tailings pile below the mill, about 1,500 tons of ore were treated. The mill building is still intact and in good condition, but all machinery has been removed except the stamps. The American Mining & Exploration Co. worked the Imlay mine in 1918 and shipped considerable silver ore. In recent years the mine has been worked on a small scale.

The Imlay mine comprises seven unpatented claims owned by E. J. Sears of Imlay and William Baker of Lovelock and has been developed by a vertical shaft 250 feet deep and an adit 1,500 feet long driven for drainage. In 1930 the owners erected a small amalgamation mill near the portal of the adit. Mill equipment consists of a Challenge feeder, two stamp batteries (850-pound stamps), and an amalgamating plate 3 feet wide by 8 feet long. Power for milling is furnished by a 15-hp. gasoline engine. The plant has a capacity of 2 tons per 8 hours. The mill operated for a time in 1935. Amalgamation made an 85-percent recovery on ore that averaged $15 per ton.

Mine equipment consists of a 6- by 6-inch Gardner Denver compressor belt-driven by 9-hp. Fairbanks-Morse gasoline engine, drills, and steel. Steel is hand-sharpened.

The formation is shale, quartzite, and limestone. Vein filling is a hard, white quartz carrying values in silver and gold and a little lead and copper. In March 1936 the Imlay mine was idle.

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Near the Imlay mine are a number of claims owned by individuals or groups. Most of these claims are in the prospecting stage.

Humboldt Valley 2 miles southwest of Humboldt station contains a deposit of sulphur. This deposit has been known since the seventies, but very little work has been done upon it. About 3 years ago O. J. Streeter, of Reno, and associates purchased 80 acres of patented land on which the sulphur deposit occurs. Up to March 1936 8 carloads of material had been shipped from the deposit to southern Oregon, where it was ground to minus 40-mesh and sold for agricultural use. The material is mined by hand, shoveled into trucks, and hauled to Humboldt station for shipment. According to Streeter the material must contain 20 percent sulphur to be marketable for agricultural use.

The sulphur occurs on the surface in a cone formed by an extinct hot spring. The cone stands about 15 feet above the level of the surrounding terrain. It is 1,000 feet long and 700 feet wide. Large, amorphous masses of sulphur occur intermixed with gypsum. The deposit is capped with several feet of calcareous material. Streeter and associates are planning to explore the deposit by drilling in the near future.

Black Canyon is 8 miles southwest of Humboldt station. In 1908 prospectors rushed to this section because rich bunches of free gold ore had been discovered, but no important deposits were found.

In 1935 the McGee property at the head of Black Canyon was under option to the contracting firm of Lindgren & Swinerton, Inc., of San Francisco, Calif. This company relinquished its option after prospecting the veins at depth by an adit 150 feet long.

On the McGee property three parallel veins outcrop over a width of several hundred yards and are traceable for about 600 feet. Veins average about 2 feet in width and dip nearly vertical. Free gold occurs in a gangue of hard, white quartz. Country rock is rhyolite.

Florida Canyon is 4 miles southwest of Humboldt station. In 1936 14 unpatented claims in this section owned by Mike Kearns were under option to W. G. Swart, mining engineer. At the time of the writer's visit a contract crew of six men was driving tunnels to explore several silicified outcrops carrying values in gold. No ore has been shipped from the property. This property is in the prospect stage.

One-quarter mile north of Florida Canyon is a deposit of kaolin owned by Kearns. The deposit is at the surface and has been prospected by numerous shallow trenches. In places the kaolin is stained with iron oxide. It is said that 2 carloads of material were shipped from the property in 1925.

The Star Peak mine is at the head of Eldorado Canyon 10 miles southwest of Humboldt station. The property comprises two patented claims owned by J. H. Hart of Lovelock. From 1914 to 1916 the mine was worked by the W. P. Hammond interests of California who erected a five-stamp amalgamation mill to treat the ore. The mill is said to have produced $130,000 in bullion from about 3,500 tons of ore. A little leasing was done in 1917, and the property has been idle since. The

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property is developed by a 200-foot vertical shaft and an adit 750 feet long.

The Star Peak mill tailings are on public land, and in 1934 M. J. Smith acquired the tailings by location. A small cyanide leaching plant was erected, and 1,500 tons of tailings averaging $4 per ton in gold and silver had been treated up to 1936. Smith operates the plant with one man during the summer when weather conditions are favorable. The tailings have been ground to minus 35-mesh and contain about 30 percent slimes.

The cost of the leaching plant was $2,000, exclusive of laboratory equipment. Leaching is done in three wood-stave tanks 18 feet in diameter and 5 feet deep. The stock-solution tank and a sump tank are each 12 feet in diameter and 10 feet high. Power is necessary only for pumping solution from the sump tank to the stock tank. This is done by a 1½-inch centrifugal pump driven by a 3-hp. Fairbanks-Morse Z-type gasoline engine. Tailings are shoveled by hand into a 1-ton mine car which is trammed to the leaching tanks and dumped. About 1 pound of lime is added per ton of tailings when the tanks are filled. By working on one shift 2 days are required to fill a tank. The leaching cycle is 36 hours, including 12 hours of washing with water. The strength of the solution is 1.6 to 1.8 pounds NaCN per ton. The tanks are emptied by sluicing.

An ingenious method is employed to elevate the solution to the leaching tanks; an air lift is used, the compressed air being furnished by a hydraulic air compressor as shown in figure 2. The solution is precipitated with zinc shavings. The fineness of the bullion recovered from the precipitant averages 200 gold and 600 silver. Recovery by leaching is 85 percent.

The Ruby Cinnabar mine in Eldorado Canyon was worked in 1908. The cinnabar occurs in limestone.

Indian District

The Indian district is in Indian Canyon on the east flank of the Humboldt Range about 8 miles south of Unionville. The district was organized in 1861. The Moonlight mine was the only important mine, and it is reported to have produced about $100,000 in rich silver ore in the early days. There has been no lode-mining activity for many years.

In the early days some placer mining was done in Indian Canyon. The biennial report of the State mineralogist1/ for 1875 and 1876 states:

> The ravine north of the Eagle (Bonanza King) mine has been located for three miles in length and 400 feet in width. All the gravel in this ravine contains more or less gold. In places, as much as 2 ounces of dust to the man has been taken out in a day, and one streak of pay dirt gave 15 ounces to two men for one half day's work with one rocker. The supply of water here is very limited, so that very extensive washings cannot be carried on. Rockers are used except for a short time in the winter, when the supply of water is more plentiful, and then the long tom is operated. The gold obtained here is coarse and worth about $17 per ounce. During

1/ Whitehill, H. E., Biennial Report of the State Mineralogist of the State of Nevada for the Years 1875 and 1876, pp. 63-64.

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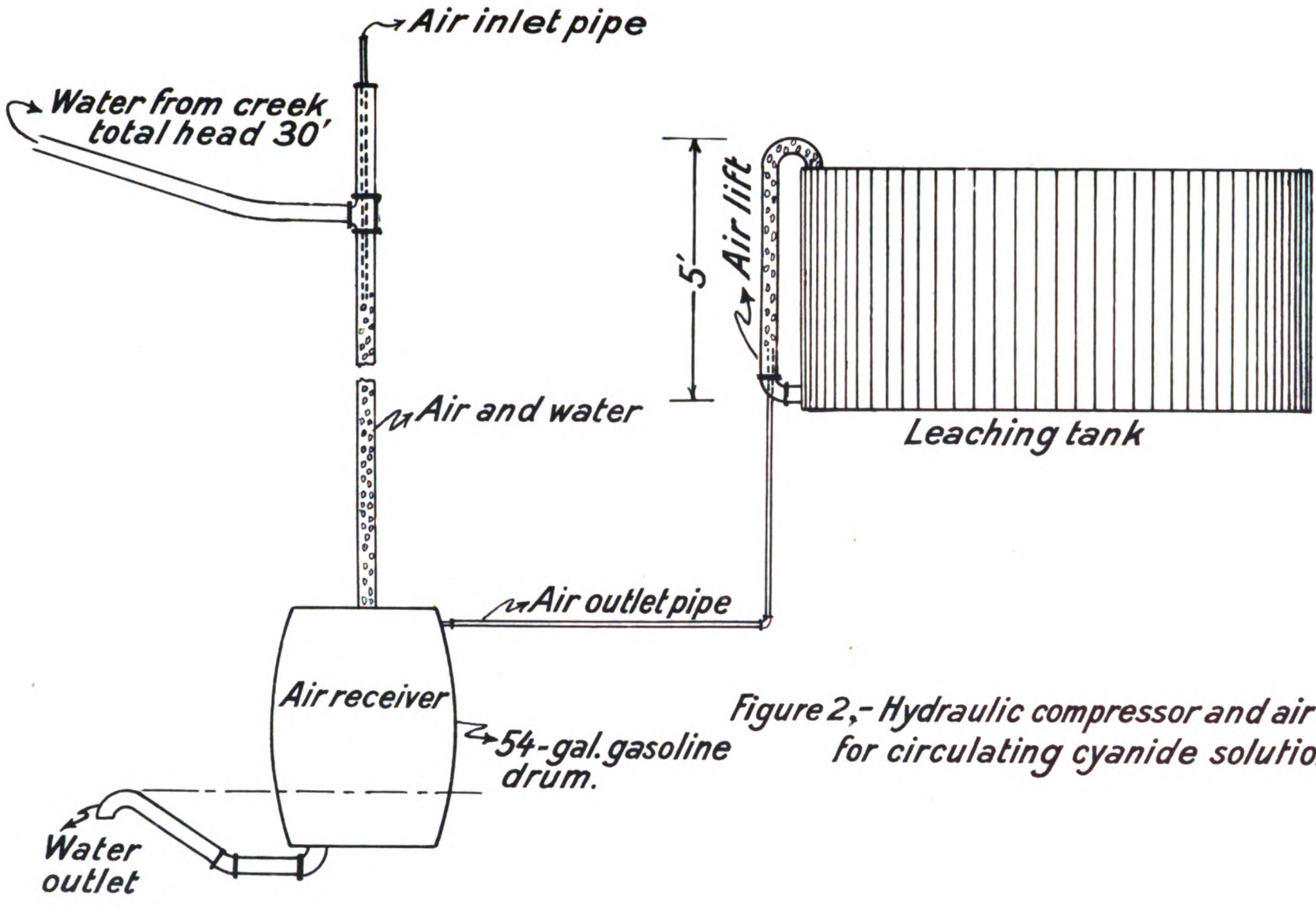

Figure 2,- Hydraulic compressor and air lift for circulating cyanide solutions.

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the month of September last (1875) about 40 rockers were in use, and about 30 white men and 125 Chinese were at work. It is impossible to get from the Chinese any information as to the amount of gold extracted, but it is thought that they get about $2 a day to the man. In several of the ravines making out of the east side of the range of mountains between the Eagle mine and Unionville good prospects of gold are found, but owing to the scarcity of water these placers are not worked.

In recent years a little placer prospecting has been done in this area.

Jersey District

The Jersey district is 43 miles southwest of Battle Mountain on the Pershing-Lander County boundary line. It was discovered by A. S. Trimbel in 1874, and the following year 500 tons of silver-lead ore were shipped to a smelter operating near Oreana. Later a small smelting furnace was erected in the district, but it was unsuccessful owing to lack of flux. The Jersey Valley mine produced considerable shipping ore from 1880 to 1910. From 1921 to 1929 small shipments of ore were made to the smelter from the Rex group of claims and the Jersey Valley mine. In recent years there has been little activity.

The formation is quartzite and porphyry, and the ore is argentiferous galena with lead carbonate.

Cinnabar has been found in Jersey Valley about 55 miles southwest of Battle Mountain. The discovery was made some years ago by prospectors who built a fire on the outcrop and noticed globules of quicksilver in the ashes. A retort was erected on the Ruby group of claims in 1918 by the Quicksilver Mines Co., and a little ore was produced from 1918 to 1921. The cinnabar occurs in sandstone, limestone, and conglomerate. The best ore is found near the sandstone-limestone contact.

Kennedy District

The Kennedy district is on the east side of Granite Mountain in the East Range 57 miles south of Winnemucca by fair automobile road. The district was discovered in 1891 by Charles E. Kennedy, who located the Imperial mine. The Gold Note mine was located about the same time by the Lawler Bros. Shortly after the discovery of these two properties the rich ore shipped to Utah smelters attracted attention to the camp, and for several years the town of Kennedy had a population of approximately 500 people.

In the late nineties the Imperial 20-stamp amalgamation mill was built and operated for 1 year. In 1901 the Imperial mill was taken over by the Wynn Lasher Syndicate, which added a cyanide leaching plant and operated until 1905. In 1914 a plant was built to test an electrochemical process patented by L. St. D. Roylance. This process was unsuccessful in treating the complex ores of the district. Several smaller mills were also erected, one of which was a custom plant built by William Jenkins.

In 1934 Charles E. Kennedy shipped 1 carload of tailings from the Imperial mill dump which averaged a little over $20 per ton. Trucking to Winnemucca costs $4.50 per ton. About 200 tons of tailings remain, which Kennedy plans to ship in 1936.

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The mineralized area is 5 miles long and 1½ miles wide; development work totals nearly 5 miles. Water is available in Cinnabar Creek, which flows through the old Kennedy townsite.

For many years the small annual production has been made principally by lessees. According to C. E. Kennedy total production has been valued at approximately $300,000. In March 1936 six men were mining in the district.

The principal rocks are granodiorite and rhyolite, the latter intruded rather irregularly by basalt. The veins range from 6 inches to 6 feet in width and dip about 45°. The vein filling is mainly quartz, with pyrite, galena, sphalerite, tetrahedrite, and a little chalcopyrite. The oxidized zone extends 25 to 150 feet below the surface.

The Sunnyside group of two claims owned by Odin Roberts of Winnemucca is under lease to Ed Amonett and partner. Monthly rental is $50 plus a 5-percent royalty on smelter returns. The ore is mined by hand methods. A portable compressor has been installed recently to facilitate operations. Two carloads of ore were shipped in 1935. The smelter returns on 1 carload shipped to the International Smelting & Refining Co., Salt Lake City, on December 30, 1935, furnished the following information:

Metal quotation:

Gold - per ounce	$35.00
Silver - do.	.77
Copper - per lb	.09025

Settlement Assay:

Au - oz	1.0825
Ag - do	22.625
Insoluble - percent	48.1
Fe - - - - do.	19.7
S - - - - do.	14.4
Cu - - - - do.	2.65
Pb - - - - do.	1.
Zn - - - - do.	.5
Lime - - - do.	.8

Metal payment:

Cu less 15 lb. at $0.06025 per lb	$2.375
Ag, 95 percent at $.77	16.550
Au, 91 percent at $35.00	34.478
Total	53.403
Less treatment	5.550
	47.853

Treatment charge:

Base charge	$4.00	
Charge for metal	1.80	
		5.80
Credit for sampling	.25	
Net treatment charge		5.55

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Wet weight - lb, ...	$79,160	
Less moisture, 4.2 percent - lb.	3,324	
Dry weight - lb.	75,836	
tons.....	37.918	
37.918 tons at $47.653		$1,814.49
Charges:		
Utah Ore Sampling Co.	$ 23.75	
Assaying.....	4.00	
Prepaid freight on sacks returned.....	3.33	
Advanced demurrage	4.00	
Freight 39.58 tons at $4.95 railroad value $45.14 per ton.....	190.00	
	$225.08	225.08
Net proceeds		$1,589.41

Other active properties are the Fourth of July group of three unpatented claims, under lease to S. J. Welter, and the Gold Note property, owned and worked by William Zuick and associates. The old Imperial group of six claims is owned by A. J. Langwith. This property was idle in March 1936.

Mill City (Central) District

The Mill City or Central district is in the Eugene Mountains in north Pershing County near the Humboldt County border.

Silver and copper ores were mined in the Eugene Mountains in the early days. The first discovery in the Central district was made by L. Vary in 1856, when the 56 Copper mine 7 miles west of Imlay was located. Copper ore was produced in this mine in 1917. The production of precious metals from the Eugene Mountains has been very small in recent years.

Tungsten ore was discovered in 1917 by Emil Stank on the southeast slope of the Eugene Mountains about 8 miles west of Mill City. Two concentrators were built in 1918 - one by the Nevada Humboldt Tungsten Mine Co. and the other by the Pacific Tungsten Co. The Nevada-Massachusetts Co. purchased the Pacific Tungsten Co. in 1924 and later acquired the Humboldt Tungsten mine. In May 1925 the Nevada-Massachusetts Co. began operations that have been continuous since then, except for a short period in 1932 when production was suspended because of no market. From 1925 to March 1, 1936, 510,000 tons of scheelite ore have been produced that averaged nearly 1 percent WO_3. Operations prior to the Nevada-Massachusetts Co. activity are estimated to have yielded 50,000 tons of scheelite ore. The property of the Nevada-Massachusetts Co. comprises 13 claims in one group. Production is about 240 tons of ore per day; 100 men work in the mine and mill. Mill City ranks among the important tungsten-producing areas of the world, and since 1925 it has been the largest producer in the United States.

The geology of the tungsten deposits has been described by Kerr.[8/] Development consists of two inclined shafts with levels at 100-foot intervals. In 1936

8/ Kerr, Paul F., Geology of the Tungsten Deposits near Mill City, Nev., March 15, 1934; Univ. Nevada Bull., vol. 28, 1934.

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each shaft was about 1,000 feet deep as measured on the incline.

The tungsten occurs as scheelite associated chiefly with quartz, garnet, and epidote. The formation comprises a series of sedimentary rocks of shale, slate, and quartzite that have been intruded by granite. The ore bodies are veinlike in form but have been produced by contact metamorphism of thin limestone members in the sedimentary series.

Two limestone beds, the Sutton and the Stank, have been developed. Figures 3 and 4 show plans and vertical sections of the Humboldt and Stank mines. In March 1936 the deepest workings were nearly 1,000 feet below the surface. The Stank has been the most productive bed; it averages 4½ feet in width. The beds dip 75° and are well-adapted to mining by shrinkage stoping. The ore, although hard, breaks well, and the walls require little support. The beds are mined in sections, each stope section being 75 to 80 feet long. Chute raises are driven at 15- to 20-foot intervals. Machine drilling is employed.

The concentrator has a daily capacity of 240 tons. Figure 5 shows the flow sheet. The scheelite ore is treated by gravity- and magnetic-concentration methods. The scheelite is unevenly disseminated as small grains in gangue composed principally of garnet, epidote, quartz, calcite, and pyrite. Some of the gangue minerals are more tenacious than the scheelite and in grinding tend to pulverize the scheelite, which is brittle. The aim in crushing the ore is to liberate the scheelite with a minimum of sliming; this is accomplished by stage reduction with rolls.

Power for milling and mining is purchased from the Sierra Pacific Power Co. at an average cost of 2 cents per kilowatt-hour. Water for milling is obtained from the mine workings and from a well 5 miles east of the property near the Humboldt River.

The direct cost of milling is about $1.25 and of mining $3.15 per ton, or a total of $4.40. This cost does not include marketing, amortization, and other indirect costs.

Mineral Basin District

The Mineral Basin district is in south-central Pershing County near the Churchill County border 26 miles southeast of Lovelock via Coal Canyon road.

Most of the iron ore in this area occurs on patented railroad grant land. In the late eighties the Reid Bros. of Lovelock shipped 500 short tons of iron ore from here to the Union Iron Works of San Francisco. The deposit was found to be on railroad land, and operations were suspended. According to J. T. Reid the ore minerals are magnetite and hematite, and the ore shipped contained over 60 percent natural iron low in phosphorus. The deposits have never been drilled to determine their extent. Reid states that a considerable tonnage is indicated.

Muttleberry District

The Muttleberry district is in Muttleberry Canyon at the south end of the Humboldt Range 9 miles by automobile road and a little south of west from Lovelock. The last 2 miles of road in Muttleberry Canyon are in poor condition. The principal property is the Old Tiger mine, which shipped some silver-lead-antimony ore in

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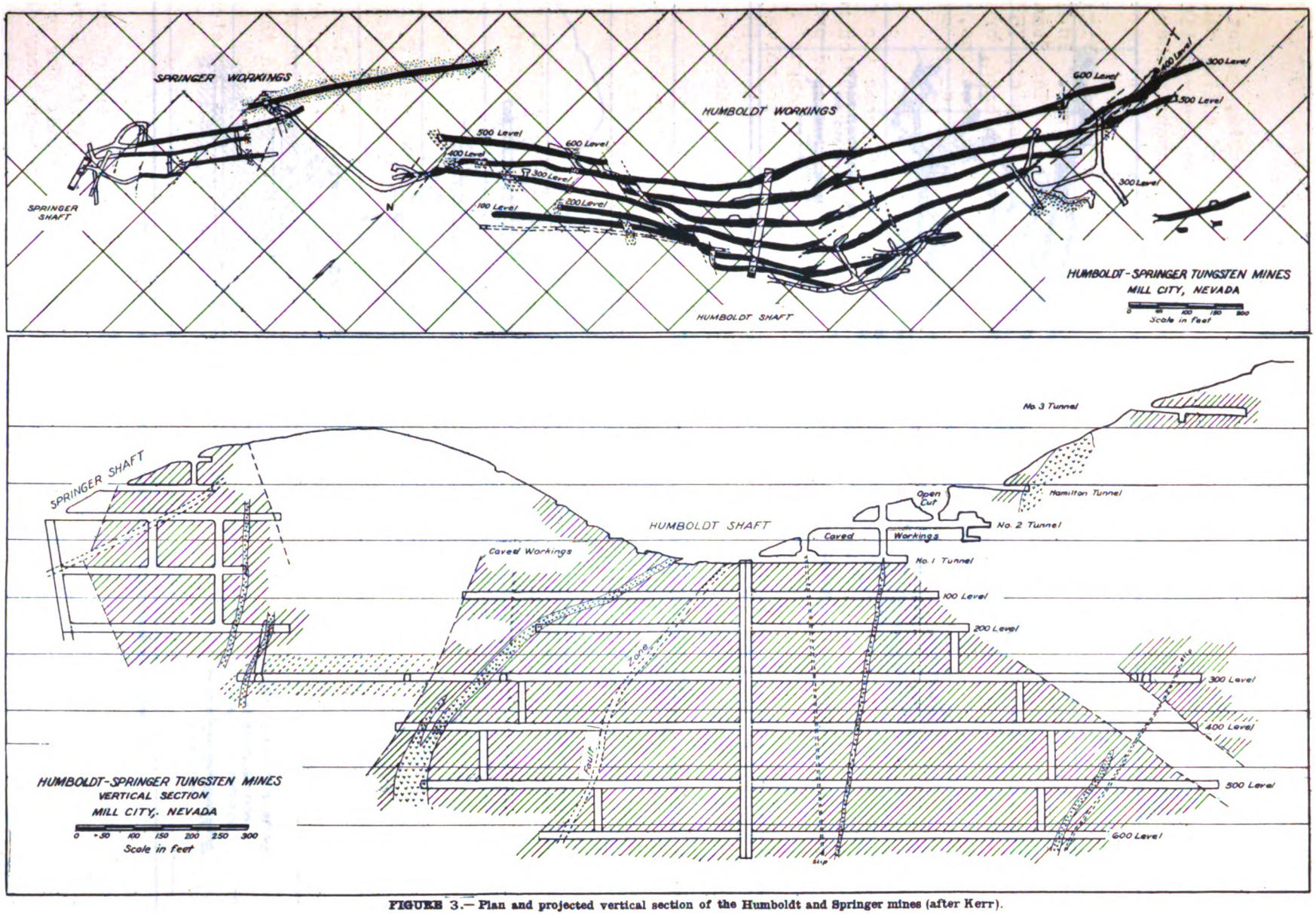

FIGURE 3.— Plan and projected vertical section of the Humboldt and Springer mines (after Kerr).

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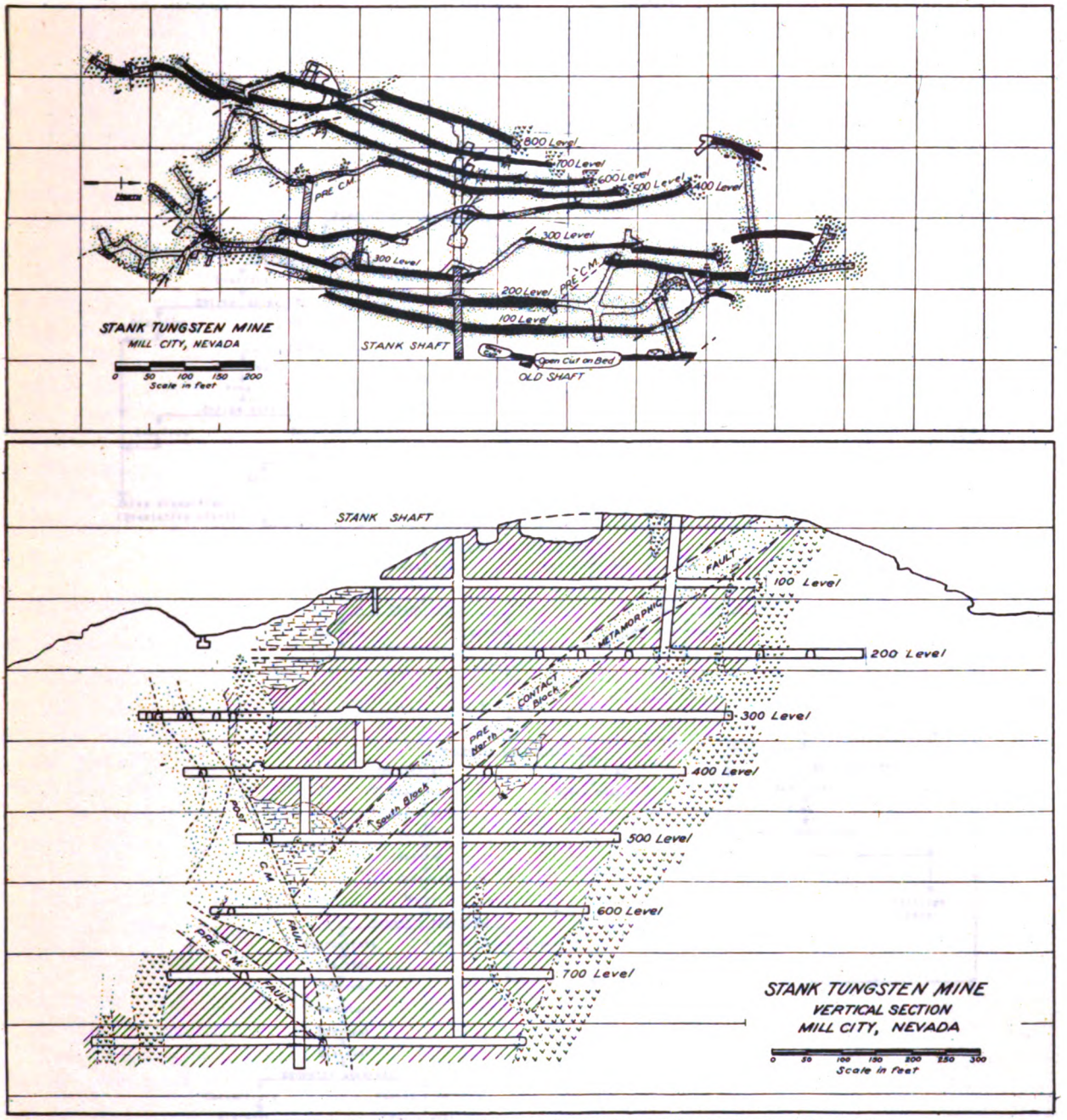

FIGURE 4.—Plan and projected vertical section of the Stank mine (after Kerr).

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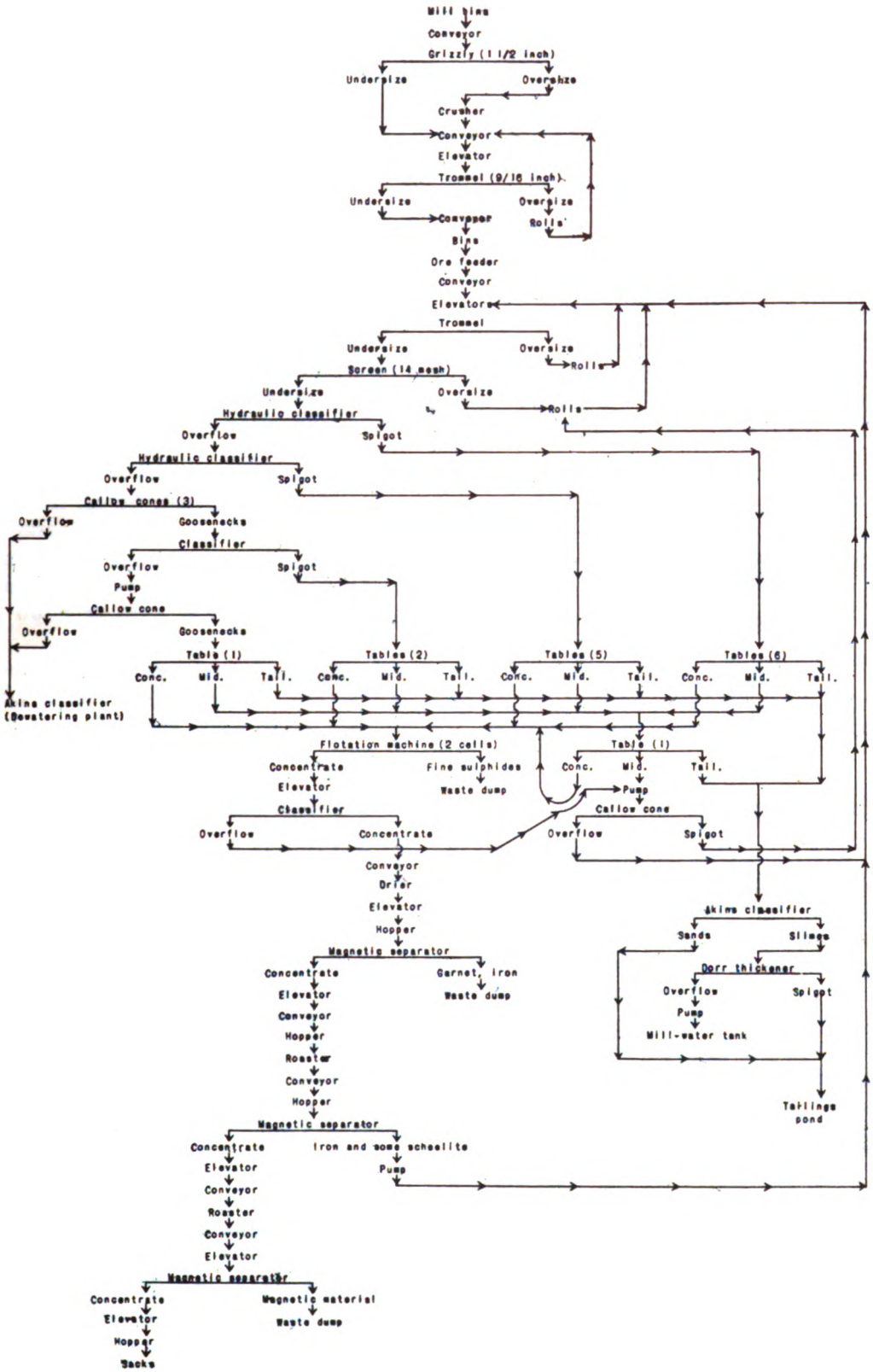

Figure 5.—Flow sheet of Nevada-Massachusetts Company's tungsten concentrate, Mill City District, Nevada.

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1910. According to J. T. Reid of Lovelock 40 cars of ore were shipped. In 1919 the property was equipped with a small Gibson mill and concentrator, but after a short period of operation the mill was dismantled and the equipment was removed. Since then the district has been idle except for desultory prospecting. When it was visited there was no activity.

The formation in the district is slate, limestone, and quartzite, capped in places by Tertiary volcanic rocks. Virtually all development work has been confined to the north side of a small ravine tributary to Muttleberry Canyon. Five tunnels have been driven into the hillside within a radius of several hundred yards. The size of the waste dumps indicates that development work totals about 1,000 feet. The ore occurs in a flat, irregular vein in limestone. The values are chiefly in silver and lead, with a little gold. Antimony and a little copper are present. In the ravine below the mine several springs produce about 1 gallon of water per minute.

Two miles north of Muttleberry Canyon on the west slope of the Humboldt Range is a bedded deposit of gypsum in limestone. The deposit is accessible by fair automobile road from Lovelock, a station 6 miles west on the Southern Pacific Railroad. The road from the mouth of the canyon to the deposit, a distance of 1/2 mile, has been washed out, so that this distance must be traversed on foot.

In the early nineties considerable gypsum was shipped from the deposit; parts of the shipping bins then erected are still standing. Subsequently some gypsum was shipped to the Western Gypsum Co. at Reno. Property has been idle for many years.

The geology of this deposit has been described by Jones[9/] and by Louderback.[10/]

The surface showings indicate extensive gypsum deposits. Owing to the dry climate the waters carrying gypsum in solution have evaporated at the surface, forming gypsite, and the gray conspicuous outcrop is a striking feature of this part of the Humboldt Range. The deposits strike parallel to the trend of the range for several thousand feet. Most of the work has been confined to an open-cut about 100 feet wide and several hundred feet long. The face of the open-cut is about 35 feet high and shows considerable folding and faulting of the formation. The gypsum occurs as a porous and friable mass intercalated with thin strata of limestone. Scattered over the surface are 12 prospecting trenches 4 feet wide, 2 feet deep, and 20 to 80 feet long. Gypsum is exposed in virtually all of these trenches. On the south end of the deposit selenite crystals are exposed. No analyses are available.

According to a location notice on the property dated July 1927 the Nevada Placer Gypsum claim covering most of the deposit is 5,280 feet long and 1,323 feet wide. The claim was located by F. F. Emmons of Lovelock and seven associates, and presumably the same group is still in possession.

Nightingale District

The Nightingale district is on the east slope of the Nightingale Range near the Pershing-Washoe County boundary line. The nearest railroad is at Nixon 18

9/ Jones, J.C., Gypsum Deposits of the United States: U.S. Geol. Survey Bull. 697, 1920, pp. 146-149.
10/ Louderback, G.D., Gypsum Deposits in Nevada: U.S. Geol. Survey Bull. 223, 1907, pp. 112-117.

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miles southwest. Lovelock is 52 miles east.

Tungsten ore was discovered in this area in 1917, and some ore was taken out during the World War and treated in the mill at Toulon. In 1929 the principal properties were acquired by the Gold Silver Tungsten Co., Inc., of which J. G. Clark of Boulder, Colo., is president. The company erected a concentrator, and according to Clark the total value of the scheelite concentrates produced has been $200,000. The last production was made by lessees several years ago. In March 1936 the company was preparing to resume operations.

Development consists of a two-compartment vertical shaft 180 feet deep and approximately 1,000 feet of lateral workings. Mining equipment includes a two-stage air compressor, a drill sharpener, and other tools.

The mill is designed to treat 100 tons of ore per day. Crushing is done with two jaw crushers and three sets of rolls. The ore is concentrated on tables. The bulk table concentrate is dried and cleaned by an electromagnet. Power for mining and milling is furnished by an Allis Chalmers Diesel engine and two Muncie oil-burning engines. Water for milling is obtained from Linton's wells, 1 mile east of the mill.

The company also owns the Star group of eight claims 6 miles east of Nightingale. Some scheelite ore was taken from this ground and milled in the Nightingale mill.

Placerites District

The Placerites district is in the low hills on the east slope of Kamma Mountains about 8 miles south of Scossa and 47 miles north of Lovelock. The first placer mining in the district was done in the early seventies by four men who are reported to have recovered $30,000 in placer gold by hand methods. In the nineties some placer mining was done, the gravel being hauled to Rabbit Hole Springs and worked in rockers. In 1928 C. J. and E. J. Stratton worked 8 months and recovered $5,000.

In 1929 a stock company called the Nevmont Placer Mining Co. acquired control of 4,000 acres of potential placer ground. Equipment was installed to work the placers on a large scale. The gravel was mined by dragline scraper and screened in a trommel; the undersize was sluiced. The quantity of water available in a reservoir excavated in the alluvium near the foot of the hills was inadequate, and in 1932 a 5-inch gravity pipe line was laid from Cow Springs to the ground, a distance of 8 miles. The dragline scraper was replaced by a gasoline-power shovel, but owing to the inadequate supply of water and other factors the venture was commercially unsuccessful.

At least five gulches in the district carry gold values. The depth of the gravel worked by small-scale methods ranges from 18 inches to 6 feet. The bedrock is composed mainly of sedimentary formations, principally slate and shale. Most of the gravel is small, but some boulders are present. The gold averages about 800 fine. A nugget which was found some years ago is said to have had a value of $212. Much black sand is concentrated with the gold in working with dry washers.

In March 1936 the Nevmont property was under lease to James A. Miller Co. of

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Tulsa, Okla. Seattle interests were planning to work the property under a sub-lease agreement. In 1935, $600 was recovered by the Seattle group in sampling the ground with a Goehring dry washer driven by a 2-hp. gasoline engine.

In March 1936 a patented dry-washer machine invented by L. C. Lester of Seattle was on the property, and preparations were under way to work the deposits. This placer machine is mounted on a Republic truck. The gravel is elevated from a hopper at the front end of the machine to a disintegrator 6 feet in length and 3 feet in diameter. After the material is disintegrated it is dropped on three horizontal shaking screens having 3/4-inch, 1/4-inch, and 12-mesh openings, respectively. The plus-3/4-inch product is discarded, and the other screen products are treated in five dry-washing machines of the continuous-blower type. The air currents of the blowers are regulated by varying the size of the air intake openings. The placer equipment is operated by a Star automobile engine. The material is to be mined by power shovel.

In recent years a few individuals have conducted dry-washing operations in the district under royalty agreement.

Rabbit Hole District

The Rabbit Hole district is 3 miles northeast of Rabbit Hole Springs and 8 miles northwest of Scossa. According to E. J. Quirk of Rosebud a placer location was made in the district in 1900, but no placer mining was done until 1916 when the Wogan brothers located several claims and took out $3,000 in placer gold. Quirk worked several summers after 1916 and recovered $600 by panning. In 1935 this was one of the most active placer areas in the State. In March 1936, 60 men were working in Coarse Gold, Red, and Long Gulches, tributary to Rosebud Canyon, and 40 dry washers were in use. The average returns from this work are said to net the operaters wages.

The depth of the gravel worked ranges from 2 to 12 feet, averaging 4 feet. The pay gravel lies above a false bedrock of clay. Several shafts have been sunk below the stratum of clay, but little gold was found. The surface gravel is rough and angular and consists principally of minus-1-inch material. Few boulders are present. In places the gravel is slightly stratified and shows signs of water action. Most of the gold recovered is nuggety. It averages 900 fine. In 1935 the largest nugget found weighed 9 pennyweight and 6 grains. The distribution of the gold is very erratic; rich pockets have been found that average as much as $50 per cubic yard. The concentrates contain considerable black sand.

In recent years several attempts have been made to work the placers on a large scale. In the fall of 1932 a company installed a washing plant at Rabbit Hole Springs. A graded road 3½ miles long was built from the placer ground to the washing plant. Five trucks conveyed the gravel to the plant. The gravel was screened, and the minus-1/4-inch screen product was washed in two power-driven sluice boxes equipped with transverse riffles. This plant was commercially unsuccessful.

Another attempt was made to work the surface gravel with a power shovel and a battery of 10 washing machines connected to a single power unit. The trommel and dry-washing machine with auxiliary equipment were mounted on a portable truck. The gas shovel had a capacity of 3/8 cubic yard. This plant operated only a short time.

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The dry-washing machines are either the Mexican air jigs equipped with bellows or continuous-blower-type machines in which the air is circulated by a rotary fan. Some of the machines are hooked up to small power units. It was generally conceded that the power-driven washer was far superior to the hand-driven machine.

At Barrel Springs in the canyon of the same name, Otto Jancke and associates have operated a placer plant for several years. More than 3,000 acres of placer ground is held by Jancke and partner. The gravel is treated in a power-driven rocker at Barrel Springs. Gravel is hauled to the plant by automobile truck. In 1935 Jancke stated that in 3 months each of four men netted $1,000. In 1934 each man earned $2,200 in 8 months. The largest nugget found by Jancke had a value of $17.50. In 1936 this ground was under lease and bond to Reno interests.

Near the mouth of Rosebud Canyon 2 miles from Rabbit Hole Springs is a deposit of bentonite clay owned by Charles F. Baker of Lovelock. Up to March 1936 several carloads of the clay had been shipped to California. The nearest railroad siding is 9 miles north at Sulphur. The deposit is flat and capped with a few inches to many feet of clay material. In an open-cut the deposit is 8 feet thick, and in all probability it extends deeper. Several test holes have been sunk in the bentonite at the base of the hill where it is exposed. Small crevices traversing the bentonite are filled with fibrous gypsum. A large tonnage of bentonite is indicated by surface workings.

Ragged Top District

The Ragged Top district is on the west slope of the Trinity Range 10 miles by automobile road west of Toulon siding on the Southern Pacific Railroad. It derives its name from Ragged Top Mountain which has a columnar structure resembling ruins.

In 1916 outcrops of garnetized limestone containing scheelite were found in this area by E. J. Mackedon and others. Shortly thereafter claims were purchased by H. M. Byllesby & Co. of Chicago, Ill., and the Chicago-Nevada Tungsten Co. was organized. Owing to the high price of tungsten during the World War the claims were rapidly explored and worked. A 50-ton concentrator was erected at Toulon siding, where water is available from wells sunk in the sediments of Humboldt sink. In 1918 the mill was taken over by the Humboldt County Tungsten Mine & Mill Co., which operated it as a custom mill for a short time. Part of the tailings were worked in 1922 by G. W. Warmoth of Lovelock and associates.

In 1922 the Toulon mill was converted into a white-arsenic plant which operated steadily until 1924. The plant equipment consisted of two seven-hearth, oil-fired Wedge furnaces, each 17 feet in diameter; two brick-dust collectors; and four sheet-iron subliming chambers. The plant had a capacity of 30 tons of arsenic ore per day. The calcines containing silver, gold, and lead were shipped to a smelter for treatment. Most of the ore for this plant was obtained from the Irish Rose mine near Battle Mountain. Some custom ores were also handled.

The Ragged Top tungsten deposits occur in hard, metamorphosed masses of limestone near a granite contact. The ore mineral is scheelite, which occurs in particles no larger than the head of a pin. The gangue mineral is mainly garnet with some quartz, epidote, calcite, pyrite, and chalcopyrite.

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Development work in the district consists of a shaft about 170 feet deep and several tunnels totaling about 1,500 feet. Most of the ore was extracted from open-cuts, of which the largest is roughly 80 feet long, 20 feet wide, and 25 feet deep. Production of scheelite ore from the district has probably totaled about 20,000 tons which averaged more than 1 percent WO_3. The principal holdings comprise the Ragged Top group of five unpatented claims now owned by the Nevada-Massachusetts Co., Inc. Since 1918 there has been no activity.

In March 1936 the Nevada Massachusetts Co., Inc., was installing equipment to rework the tungsten tailings at Toulon.

Relief (Antelope Springs) District

The Relief or Antelope Springs district is 22 miles east of Lovelock by fair desert road via Coal Canyon. The quicksilver deposits are at the south end of the East Humboldt Range.

The quicksilver deposits were discovered in 1912. A 12-pipe retort was erected in 1914 on ground later owned by the Pershing Quicksilver Co., and subsequently a similar retort was built on another property 1½ miles east. The two retorts operated until 1919 and are said to have produced 200 flasks of mercury. Interest in the district was revived by the boom in mercury mining in 1927, and several companies were financed.

The rocks are mainly sedimentaries consisting of limestone, sandstone, and shale. The cinnabar occurs in the limestone and sandstone at or near their contact with the overlying shale. The ore bodies occur in lenses 5 to 40 feet wide, the boundaries of which are determined by the lowest-grade material that can be profitably mined. The limestone bed is quite hard and dense, and little timber is required in mining.

The Nevada Quicksilver Mine, Inc., acquired 328 acres in the district, and in 1928 it was one of the largest producers of mercury in the United States. The Mammoth property was added to its holdings in 1929. The reduction plant built in 1928 consisted of a rotary kiln, 3 feet in diameter and 40 foot in length, with dust-precipitating and mercury-condensing equipment. The capacity of the plant was 40 tons per day. For a time production was 600 flasks per month. The company ceased operations in 1931, and the mill was dismantled and the equipment sold several years ago. The mine is developed by a shaft 450 feet deep.

The property of the Pershing Quicksilver Co. 3 miles south of the Nevada Quicksilver Mine, Inc., comprises 8 lode-mining claims, 160 acres of ground held under placer locations, and 160 acres of patented mineral land. The company became active in the district in 1926. A reduction plant was completed in February 1928. The company suspended operations in 1931 owing to a drop in the price of quicksilver.

The mine is opened by three adits. The ore is blocked out by raises and crosscuts at 50-foot intervals. The shrinkage system of mining is employed. The ore breaks well, and little timber is required for support.

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The property is equipped with a power plant consisting of an 80 hp. and a 120-hp. Diesel engine. Electric current is also purchased from the Sierra Pacific Power Co. Water is scarce in the region, but enough for ordinary needs is piped from Antelope Springs 2 miles away.

Figure 6 shows a flow sheet of the reduction plant prepared from an article by Adamson.[11] The rotary furnace has a capacity of about 50 tons of ore per day and the Herreshoff of 85 tons. The mercury from the condensers is run into a concrete launder that has an outlet into one of two submerged cast-iron pots holding 100 flasks each.

O. H. Oleson of Lovelock and E. E. Grelle own six claims and two fractions adjoining the property of the Nevada Quicksilver Mine, Inc. Development work comprises a 75-foot shaft, 400 feet of tunnels, and surface workings, a total of 1,000 feet. About 60 tons of ore left on the dump were taken out during development. Other claims are held in the district by various owners, but none were active when the author visited them.

There is a deposit of antimony about 6 miles northeast of the quicksilver deposits. George Senn first worked the deposit in 1864 and erected a small crucible furnace that is reported to have been unsuccessful. During the World War 400 tons of ore averaging 35 percent antimony was produced. The property has been idle for many years.

Rochester District

The Rochester district is in the central Humboldt Range 9 miles east of Oreana, a station on the Southern Pacific Railroad. The Packard part of the district is 2⅔ miles south of the Rochester townsite.

The Rochester district was discovered and named in the sixties by prospectors from Rochester, N.Y. The Relief mine in the southern part of the range 4 miles south of Nenzel Hill was worked during the sixties and seventies. In 1905 Charles E. Stevens located claims on Nenzel Hill at the head of Rochester Canyon. These claims eventually came into the possession of Joseph F. Nenzel. In 1912 Nenzel shipped a small lot of float ore that gave surprisingly high returns. With the subsequent discovery of several silver-bearing veins development proceeded rapidly, and in 1913 Rochester Canyon had a population of about 2,000. Two companies, the Rochester Mines Co. and the Nevada-Packard Mine Co., built all-slime cyanidation plants in 1915. The mill of the Rochester Mines Co. had an initial capacity of 100 tons per day, which was later increased to 160 tons. The plant of the Nevada Packard Mines Co. had a capacity of 120 tons. In 1917 a mill reported to have cost $300,000 was erected at Packard by the Rochester Combined Mines Co. After the mill had been operated only a few weeks it was shut down, and in 1922 the equipment was moved to Candelaria, Nev.

The principal producer, the Rochester Mines Co., was threatened by apex litigation in 1917, but by compromise and consolidation litigation was avoided, and the Rochester Silver Corporation was formed in 1920. This company ceased operations in 1929, and the equipment of the mill was sold. In March 1936 the principal active property in the district was the Buck and Charley mine owned by the Rochester

11/ Adamson, W. G., Recent Progress in the Metallurgy of Quicksilver: Eng. and Min. Jour., vol. 128, pp. 503-505.

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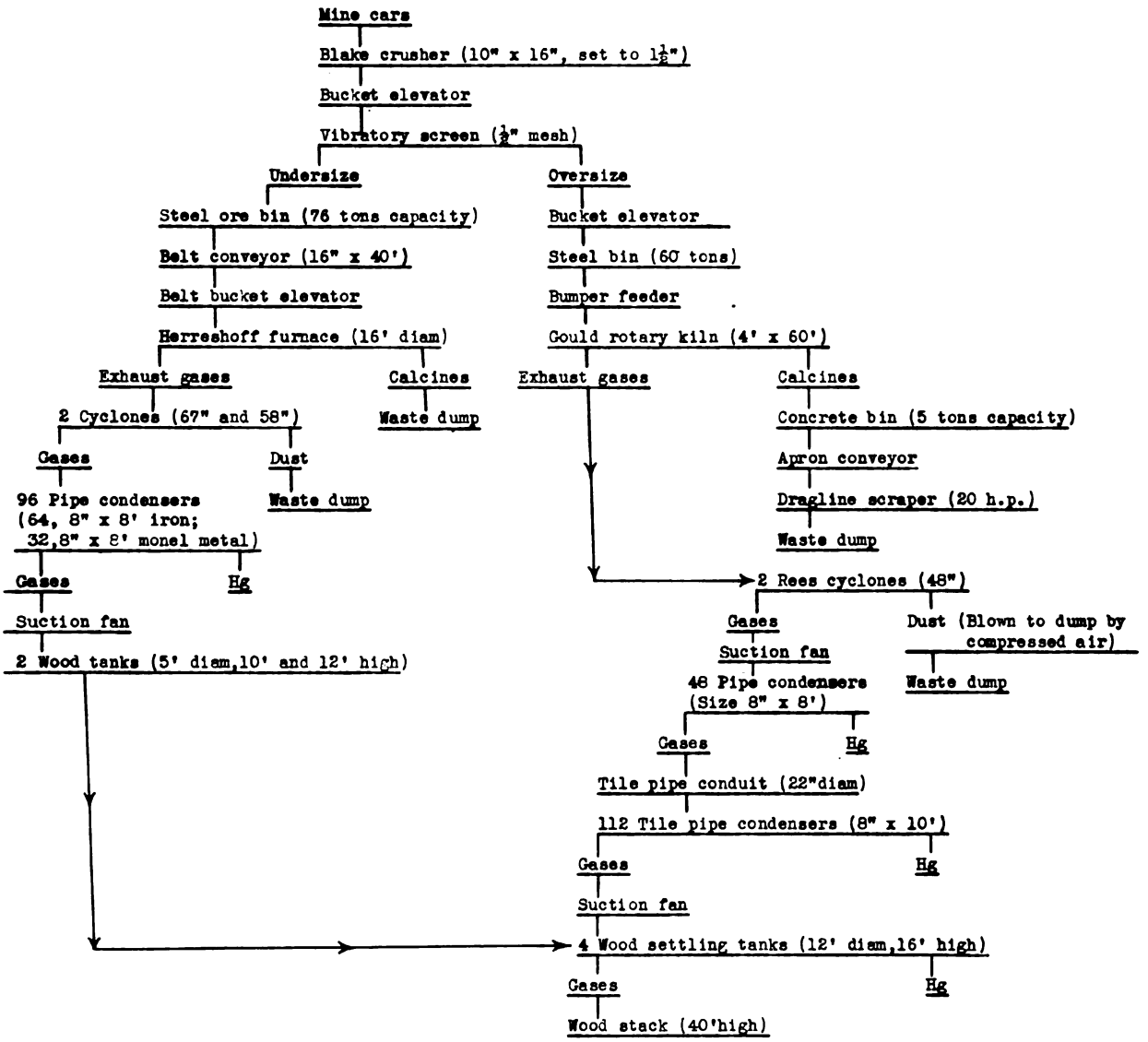

Figure 6.—Flow sheet of Pershing Quicksilver Company plant, Relief District, Nevada.

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Plymouth Mines Co. The production of gold and silver from lode mines in this area from 1912 to 1934 is shown in table 2.

TABLE 2. - Silver and gold produced from deep mines, Rochester District, Nevada, 1912-34

Year[1/]	Tailings and ore (short tons)	Value of gold	Silver (fine oz.)	Value of silver	Value per ton	Total value
1912	144	$491	6,850	$4,213	$32.67	$4,704
1913	16,152	52,350	701,395	423,664	29.47	476,014
1914	14,499	71,769	621,833	344,276	28.69	416,045
1915	26,665	105,407	663,791	337,684	16.62	443,091
1916	67,992	81,228	816,620	538,923	9.12	620,151
1917	88,371	152,855	799,865	660,514	9.20	813,369
1918	95,747	177,120	810,974	815,034	10.36	992,154
1919	103,662	117,899	667,161	747,398	8.35	865,297
1920	75,048	130,715	620,046	676,328	10.75	807,043
1921	87,628	176,144	667,084	667,129	9.62	843,273
1922	116,455	107,033	800,238	800,238	7.79	907,271
1923	91,374	124,326	664,714	545,077	7.33	669,403
1924	28,779	113,882	329,819	220,979	11.64	334,861
1925	8,718	34,012	60,012	41,655	8.68	75,667
1926	484	9,904	3,737	3,140	26.95	13,044
1927	23,939	42,450	156,633	88,811	5.48	131,261
1928	30,627	39,448	240,346	140,732	5.88	180,180
1929	4,479	7,992	52,628	28,345	8.11	36,337
1931	28	2,681	295	86	98.82	2,767
1932	641	5,070	2,029	573	8.80	5,643
1933	310	5,991	316	111	19.68	6,102
1934	606	14,308	11,857	7,648	36.23	21,956
Total	882,348	1,573,075	8,698,243	7,092,558	[2/] 9.82	8,665,633

1/ No production in 1930.
2/ Average value per ton.

The geology of the Rochester district has been described by Schrader[12/] and by Knopf.[13/] The principal ore deposits are silver-gold quartz veins and stockworks. The stockworks occur at Packard and consist of a network of narrow veinlets in rhyolite. The gangue consists of quartz, and the chief economic mineral is finely disseminated argentite asscciated with gold. Other metallic minerals found in minor quantities are pyrite, sphalerite, galena, tetrahedrite, covellite, and chalcopyrite. The veins worked by the Rochester Silver Corporation were productive from the surface to the 1,200-foot level, a vertical depth of 700 feet. Below this level little ore was found.

12/ Schrader, Frank C., The Rochester Mining District, Nevada: U.S. Geol. Survey, Bull. 580-M, 1914, 47 pp.
13/ Knopf, Adolph, Geology and Ore Deposits of the Rochester District, Nevada: U.S. Geol. Survey, Bull. 762, 1924, 78 pp.

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The Buck and Charley mine is on the south side of Rochester Canyon a short distance below Lower Rochester. In 1935 Charles Mayer, working the property under lease, shipped several carloads of rich ore, and the Rochester Plymouth Mines Co. was organized and a 50-ton flotation mill built.

The mine is developed by several adits and a shaft 200 feet deep sunk from the lowest adit level. Most of the ore has been mined from near the surface. Besides gold and silver, the ore carries pyrite, zinc blende, and galena. Until April 1936 about 19,000 tons of ore ranging in value from $6 to $20 per ton had been treated in the flotation mill.

Figure 7 shows the mill flow sheet. It was designed for a capacity of 50 tons per 24 hours, but as much as 70 tons have been treated. The cost of the mill was about $45,000. The concentrates range from $180 to $400 per ton in value. Concentrates are shipped to the smelter by truck. Moisture in the concentrates after filtering averages 12 to 18 percent. The reagents used are aerofloat, xanthate, and cresylic acid. The pulp density in the flotation circuit is maintained at 25 percent solids.

Water for milling is obtained from the mine. Power is purchased from the Sierra Pacific Power Co. The motor horsepower required for milling is 121. Thirty men are employed in the mine and the mill.

There are two other mills in the district both of which were idle in March 1936. The Lonney amalgamation concentration mill is equipped with 15 stamps. This property is under lease to E. Lyon of Rochester. The Lincoln is a 2-stamp amalgamation mill.

In addition to the Rochester Plymouth Mines Co. operations about 10 men were leasing or prospecting properties in the area in March 1936.

Rosebud District

The Rosebud district is in the Kamma Mountains 35 miles northwest of Imlay, a station on the Southern Pacific Railroad. Sulphur, 9 miles northwest, is the nearest shipping point. Silver-gold ore was discovered in 1906, and a short-lived boom followed. Since 1908 the annual production, chiefly from leasing operations, has been small but consistent. Total production is estimated to be $125,000. The only mill that operated in this area was erected several years ago by the American Mining & Milling Co., which had a bond and lease on the Brown-Palace mine. The mill had a daily capacity of 50 tons. The company became involved in difficulty, and the equipment of the mill was dismantled and sold. Judging from the tailings dump, several thousand tons of ore were treated in the mill. A. H. Leach sampled these tailings and obtained an average of $2 per ton at current metal prices.

The veins at Rosebud are all in rhyolite, which in most places is extremely altered and somewhat silicified, kaolinized, and sericitized, and contains pyrite that has been changed to iron oxide. Most of the veins show little quartz. The mineralized material is largely soft, white kaolinite. In general the deposits do not have definite walls.

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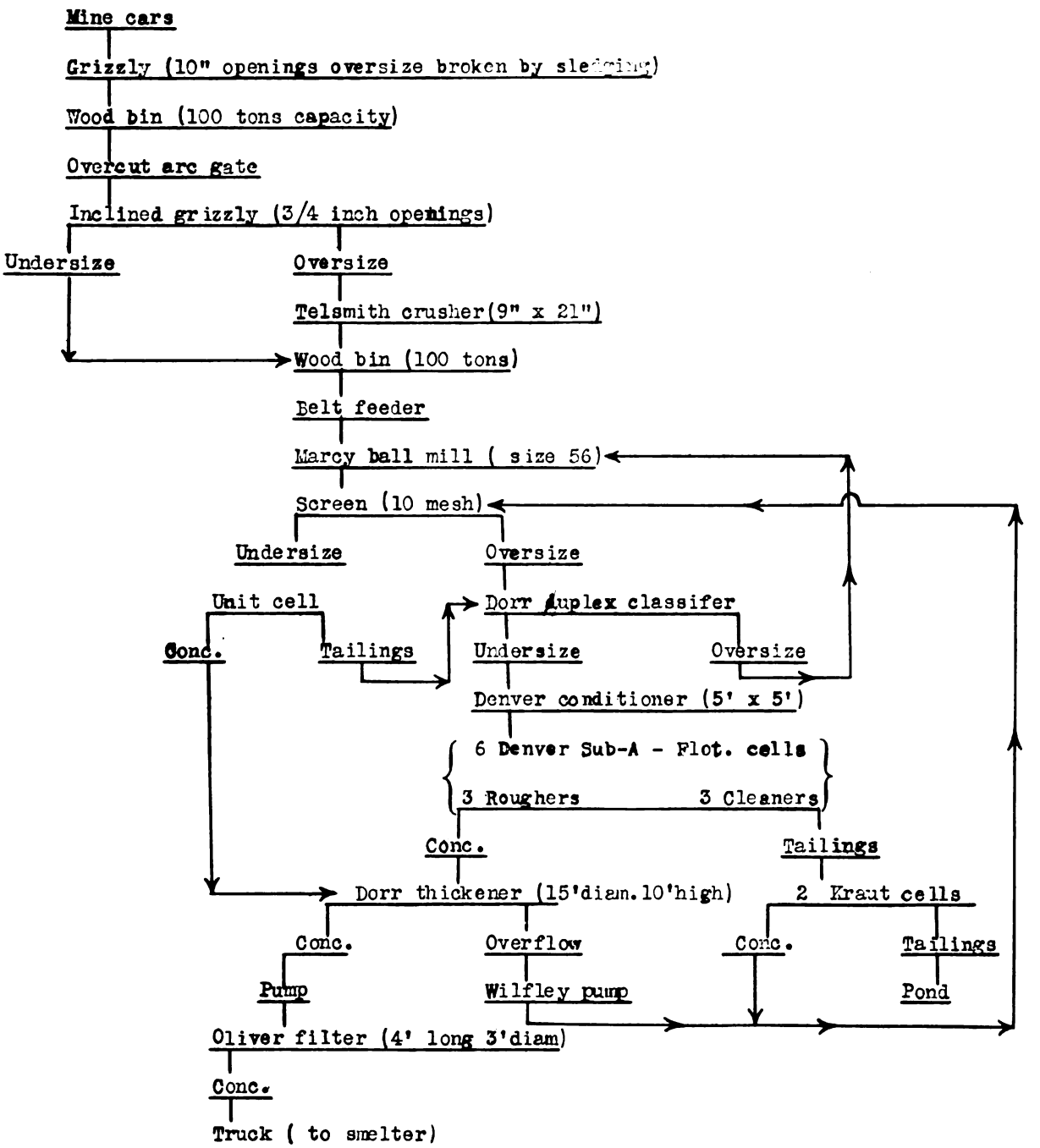

Figure 7.— Flow sheet of Rochester Plymouth Mines Company mill, Rochester District, Nevada.

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The principal property is the Brown-Palace mine on the Golden Jupiter unpatented claim owned by Paul Webster of Rosebud. The mine is entered through several tunnels. Total development work is approximately 1,600 feet. Air drills are used in mining. Compressed air is furnished by an Ingersoll-Rand type-11 compressor driven by an automobile engine.

Several years ago six lessees, calling themselves the "Bagged Six," discovered ore on the Brown-Palace ground and shipped 12 carloads which are reported to have had a gross value of $81,000. In March 1936 the Brown-Palace mine was under lease to A. H. Leach, Jeff Rice, and R. L. Smith. Royalty is 20 percent on net smelter returns, and the mine is leased for 6 months. The ore mined by Leach and associates was taken from the stope that produced the 12 carloads of rich ore. It is necessary to screen the ore to obtain a shipping product. The minus-1-inch screen product shipped constitutes about 50 percent of the mine-run material.

Smelter returns on a carload of screened ore shipped by Leach on February 18, 1936, to the International Smelting & Refining Co., of Salt Lake City, furnished the following information:

Metal quotation:		
Gold - per ounce	$35.00	
Silver do.	.77	
Settlement assay:		
Ag - oz.	9.625	
Au - do.	.3925	
Copper - percent	.1	
Fe - - - do.	4.3	
Sulphur do.	1.6	
Metal payments:		
Ag - 95 percent	$ 7.041	
Au - 91 percent, 35.00 per oz.	12.501	
Gross metal payment	$19.542	
Treatment charge	3.20	
Net value per ton	16.342	
Base charge	$3.45	
Credit Utah Ore Sampling Co.	.25	
Treatment charge	3.20	
Net weight - lb.	119,100	
Moisture, 4.9% - lb.	5,836	
Dry weight - - - do.	113,264	
tons	56.632	
56.632 tons at $16.342		$925.48
Utah Ore Sampling Co.	$35.73	
Assaying	3.00	
Freight, $3.20 per ton	190.56	
	229.29	229.29
Net proceeds		696.19

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The haul from Rosebud to Sulphur costs $2 per ton on contract.

Adjoining the Golden Jupiter claim is a group of three claims, two patented and one unpatented, owned by A. H. Leach and S. A. Bunce. The vein on this property is 3 feet wide and dips 70°. Development work comprises a shaft 125 feet deep and several hundred feet of lateral workings. The vein is exposed on the surface for a length of 250 feet. Three carloads of ore were shipped from this property in 1935. A shipment made on March 6, 1935, to the United States Smelting & Refining Co., Salt Lake City, furnished the following information:

Settlement assay:

Au - oz	0.23
Ag - do	28.0
Insoluble - percent	77.2
Fe - - - - do.	6.4
S - - - - do.	2.8

Wet weight - lb	77,540	
Less moisture, 4.5 percent - lb	3,490	
Net weight .. - lb	74,050	
tons		37.025
Value of gold at $31.8183	$7.32	
Ag, 100 percent at $0.7575	21.21	
	28.53	
Less 5 percent Ag.	1.06	
	27.47	
Less working charge	4.75	
	22.72	
37.025 tons at $22.72 per ton		$841.21
Freight 40 tons per minute, $3.90 per ton.	$156.00	
Freight surtax, 7 percent	10.92	
Hauling $2.20	85.29	
	252.21	252.21
Net returns		589.00

Three groups comprising 14 unpatented claims are owned by S. A. Bunce and John F. Kunz. Development work on these claims is superficial and totals little more than 100 feet. Two carloads of ore averaging, respectively, $14 and $28 per ton were shipped in 1935.

E. J. Quirk of Rosebud owns 19 unpatented claims in one group. These claims have been developed by five tunnels and a 75-foot shaft, totaling roughly 2,000 feet of workings. Two veins are exposed on the Quirk property that average 4 feet in width with dips ranging from 45° to 75°. Quirk claims that considerable mill ore averaging $10 or more per ton is exposed on the property. Sampling data are not available, and no ore has ever been shipped. Several other properties have produced shipping ore.

In 1935 lessees in the Rosebud district could send their ore to the 100-ton cyanide mill at Seven Troughs 30 miles distant. This mill was operated in 1935 but was idle in March 1936. The cost of hauling to Seven Troughs is $4 per ton,

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and the milling charge on ore having a value less than $25 per ton is $3.50. The Seven Troughs mill paid 92 percent of the assay value in gold and silver.

Rye Patch (Echo) District

The Rye Patch or Echo district is on the west flank of the Humboldt Range in central Pershing County 4 miles east of Rye Patch, a station on the Southern Pacific Railroad. The principal property is the old Rye Patch (Butte) mine, located in 1864. An English company purchased the mine in 1869, shipped ore to its mill in Reno that year, and built a 10-stamp mill at Rye Patch in 1870. The mine and mill were taken over by the Rye Patch Mining Co. of San Francisco, Calif., in 1873, but the ore gave out the following year. From 1869 to 1874 the Rye Patch mine is said to have produced ore valued at about $1,000,000, principally in silver. The American Mining & Exploration Co. prospected the property without success from 1919 to 1921. In 1914 and 1923 unsuccessful attempts were made to cyanide the tailings dumps. The property has been inactive in recent years.

The Rye Patch property, comprising three small patented claims and totaling 32.15 acres, is owned by John P. Fanning of Hollywood, Calif. The mine is entered through several tunnels. Development work comprises 6 miles of underground workings. The ore occurs along the bedding of limestone layers between two faults. The mass of limestone between the faults has been shattered and recemented with quartz and calcite. Besides quartz and calcite, pyrite, galena, sphalerite, tetrahedrite, and silver sulphide occur. It was reported that some of the pillars left in the old workings contain ore, but a brief examination of part of the extensive stope and underground workings indicated that the old-time miners did a very thorough job of mining.

The La Toska mine near Wright Canyon was an active producer in the early days. A large amount of development work has been done in the mine, and a little gold-silver ore was mined in 1916. In 1918 a little scheelite ore was mined from a deposit in Wright Canyon. This deposit is of the contact-metamorphic type.

Tungsten ore was discovered two miles southeast of Rye Patch by George V. Gordon in 1933. The Rare Metals Corporation purchased the property shortly after its discovery and acquired patented railroad land adjoining it. Four mining claims and 320 acres of patented land are owned by the company. Production has been two carloads of crude, hand-cobbed scheelite ore - one carload averaged 28 percent and the other 40 percent tungstic acid (WO_3).

Development consists of a shaft 100 feet deep, a tunnel 300 feet long, and a winze 50 feet deep. A development crew of three men was at the property in March 1936. The property is equipped with a Gardner-Denver two-stage vertical compressor driven by an 80-hp., caterpillar Diesel engine. Drilling is done with mounted jackhammers using 7/8-inch hexagonal steel and a stoper using 1-inch quarter-octagon steel.

The formation is limestone intruded by pegmatite dikes and metadiorite. The scheelite occurs in the pegmatite associated with feldspar, fluorite, beryl, and quartz. The average width of the two dikes is about 1 foot. In prospecting, Gordon observed a greenish mineral in the pegmatite which he believed to be beryl. A specimen of the pegmatite was sent to the Mackay School of Mines for identification of the minerals. Beryl was identified, and it was discovered that the

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pegmatite contained considerable scheelite, which was more important commercially than the beryl.

Two miles south of Eldorado Canyon is the Gold Standard property. In 1935 it was acquired by a San Francisco group called the Pacific Syndicate. According to J. B. Stott, in charge of operations, the company started development in March 1935 and up to April 1, 1936, had blocked out approximately 600,000 tons of low-grade ore averaging $2.40 per ton, chiefly in gold. When the property was acquired little development work had been done, and no ore had been shipped or milled. The objective of the company is to block out 1,000,000 tons of ore averaging $2.25 per ton or better before erecting a mill. Milling tests indicate that the ore is amenable to cyanide treatment. When the writer visited the property development work was being done by 24 men. The ore was drilled both by hand and machine. The cost of drifting and crosscutting averages about $5 per foot. The ore deposit has been opened by three tunnels, several shafts, crosscuts, and drifts totaling 3,000 feet. The mineralized zone has been traced on the surface for a distance of 950 feet. Crosscuts show that the zone ranges from 50 to 250 feet wide. Gold and a little silver occur in a series of limestone and shale beds that have been brecciated and silicified. Water for milling is available in Eldorado Canyon and Cold Springs, the combined flow from the two sources being about 40 miner's inches. The power line of the Sierra Pacific Power Co. is 3 miles west of the property.

Sacramento District

The Sacramento district is on the west flank of the Humboldt Range 5 miles east of Oreana, a station on the Southern Pacific Railroad. It extends from Limerick Canyon on the south to Pole Canyon on the north, a distance of 4 miles.

In the early days the Humboldt Queen mine was the principal property. Prior to 1900 this mine produced considerable lead-silver ore that was milled at Winnemucca and Mill City. According to John Ferretto of Lovelock, who owned the property prior to 1925, the last shipments of ore from the mine were two carloads averaging, respectively, $19 and $22 per ton shipped in 1919 by Laurence Zunini to a Utah smelter. In recent years this property has been idle.

According to Ransome,[14/] the country rock at the Humboldt Queen mine is limestone that is sharply and complexly folded. The vein follows the bedding of the limestone, and as it is near the surface the same vein outcrops several times as a result of erosion cutting across its folds. The vein filling is quartz and calcite, containing sulphides. The principal values are silver and some gold associated with pyrite, galena, and sphalerite.

In 1924 R. H. Rowland of Lovelock located a dumortierite deposit in Humboldt Queen Canyon. This deposit was sold to the Champion Sillimanite, Inc. The company's holdings comprise seven patented claims. Dumortierite has been mined intermittently since 1925, and the total production up to 1936 has been 2,800 tons. In March 1936 seven men were employed at the property.

Dumortierite is a rare aluminum silicate used with other silicates in the

14/ Ransome, Frederick Leslie, Notes on Some Mining districts in Humboldt County, Nev.: U. S. Geol. Survey Bull. 414, 1909, pp. 34-35.

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manufacture of spark plugs and refractories. The deposit in Pershing County is said to be the only known commercial source of this mineral in the world.

The dumortierite occurs in irregular lenses in a keratophyre formation. The largest lens found contained 600 tons. The mineral is readily distinguishable by its color, which ranges from light pink to deep purple, while the keratophyre is white. The deposit outcrops on the side of the canyon so that it is mined mainly by the open-cut method; however, some has been mined by open stopes from several tunnels. Development work totals about 1,400 feet.

Mining is done with jackhammers using 7/8- and 1-inch hexagonal steel. Compressed air is furnished by a two-drill portable compressor. Drill steel is sharpened by machine. The ore is blasted with 40-percent gelatin dynamite. In places the mineral is traversed with bands of country rock, and it is hand-cobbed and sorted into two grades. The sorted material is transported to a loading bin by a home-made gravity tram equipped with two buckets holding 500 pounds each. From the loading bin it is hauled to Oreana by truck for rail shipment east. Truck haul to Oreana, a distance of 6 miles, is done on contract at $2 per ton.

The detrital material covering the deposit in places contains angular fragments of dumortierite. The detritus is scraped down the hillside by a 78-hp. Sauerman dragline outfit. The dumortierite is so valuable that fragments the size of a hand specimen are cobbed and saved.

San Jacinto District

The San Jacinto district is at the south end of the Antelope Range about 10 miles southwest of Humboldt, a station on the Southern Pacific Railroad. The district was discovered by "Poker" Brown in the early seventies. Considerable prospecting work has been done in the district, but most of it is superficial in character. The deepest shaft is 150 feet. Some silver-lead ore was shipped from here in 1876. No large production is recorded. For many years the district has been idle.

The country rock is mainly slate, limestone, and granite. The veins, which are 2 to 6 feet wide, occur mainly in the slate. The veins contain bunches of argentiferous galena and carbonate of lead.

A deposit of diatomaceous earth occurs 17 miles by road southwest of Humboldt in the east foothills of the Trinity Range. This deposit was first located about 1921. George Copley of Imlay owns 160 acres comprising the southwest part of sec. 20, R. 30 N., T. 32 E. in this area. This property has been developed by 15 shafts and open-cuts. The deepest shaft is 16 feet. The diatomaceous earth occurs beneath an overburden of detrital material 6 inches to 3 feet deep. The diatomaceous earth is 6 to 12 feet thick, where exposed in open-cuts and shafts, and extends over an area 1,800 feet long and about 600 feet wide. Tests show that the material is of good quality, and preliminary prospecting indicates a large tonnage. When the new road is completed over Rye Patch Dam, now under construction, the railroad siding at Rye Patch will be about 6 miles from the deposit.

Sawtooth District

The Sawtooth district is in northern Pershing County 12 miles east of north from Scossa by automobile road.

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Placer gold was discovered in this area in 1931 by Rufus Stevens as a result of prospecting stimulated by the discovery of gold veins at Scossa. During the summer of 1931, 35 or more men were dry-washing in the district with encouraging results. It is said that some individuals recovered as much as $35 per day. In 1932 the Oregon-Nevada Mining Co. acquired about 300 acres and attempted to work the gravels on a large scale. According to John G. Huntington, mining engineer, production of placer gold has been valued at about $12,000.

The Oregon-Nevada Mining Co. used a caterpillar tractor and scraper to haul the top gravel to a washing plant which comprised a trommel screen with 3/4-inch holes and a disintegrating machine equipped with wooden paddles. After the material was disintegrated, it was treated on two home-made concentrating tables. The concentrates from the tables were cleaned with a hand rocker. This plant was unsuccessful, and the holdings of the company were taken over by A. A. Goehring of Sawtooth. In March 1936 Goehring was planning to lease the placer ground to individuals on a rental basis of 25 cents per day for each hand-driven dry washer used.

An unusual feature of the placer is that the best values are found at shallow depths - 8 inches to 3 feet above a false clay bedrock. The gravel is rough and angular, and considerable clay is present. The clayey material has to be dried and pulverized before satisfactory saving can be made with dry washers. The gold is coarse and rough and averages about 880 fine. Nuggets worth as much as $4.50 have been found.

Scossa District

The Scossa district is in the Antelope Range 50 miles by road north of Lovelock and 28 miles west of Imlay. It was discovered in 1930 by James and Charles Scossa. The value of the ore shipped to smelters or treated locally is estimated to be about $30,000. Seven carloads of ore shipped from the Dawes property are said to have averaged $50 per ton. From 1934 to March 1936, $9,000 in bullion was recovered from ore treated in a small mill owned by Olsen brothers and their associates. The nearest water is in Rosebud Canyon, 2 miles north of Scossa, where wells have been sunk.

The formation comprises slates and mica schists irregularly interbedded with strata of limestones and sandstones. The slates are intruded by small quartz-diorite dikes. The ore occurs in quartz veins 1 foot to 6 feet wide. The dips range from 50° to 75°. The values are chiefly in gold with some silver.

The Scossa strike was made on the North Star claim of a group owned by the Dawes Gold Mine, Inc. Rich ore was found at a place on the surface where the vein is about 6 feet wide. About 18 inches of the hanging-wall part of the vein contains stringers of gold-bearing quartz of high value. For a time after the initial discovery there was considerable activity. The deepest shaft in the district is the Dawes shaft, 400 feet deep as measured on the incline. Total development work is estimated to be about 4,000 feet.

The Dawes property consists of three claims. Lateral workings from the Dawes shaft total 1,000 feet. In 1935 the company erected a mill 2 miles north of Scossa that operated only a short time. Mill equipment consists of a jaw crusher, a 4-foot-diameter ball mill of the Ellis type equipped with 125-pound steel balls, a 6- by 4-foot amalgamating plate, and a small concentrating table. The power for

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milling is furnished by a Witte gasoline engine.

The Olsen property contains 5½ acres. The shaft on this property is 70 feet deep. Mine workings total approximately 350 feet. The vein averages 16 inches in width and dips 75°. In March 1936 it was the only active property in the district. The grade of the ore mined averages $25 per ton. The ore, which is mined by hand methods, is hauled 3/4 mile to a mill having a capacity of 2 tons per 12 hours. The mill equipment consists of a Straub grinding unit having a 30-mesh screen, and an amalgamation plate 6 inches wide and 2 feet long. Mercury is used in the Straub mill. The ore is screened by hand through a 1-inch-mesh screen. The oversize is stored for future treatment. The undersize is sent to the Straub mill. Power for milling is furnished by a Mecco 6-hp. gasoline engine. Water for milling is hauled by truck from a well 2 miles away. Some mill water is reclaimed. Water consumption is roughly 125 gallons per ton of ore.

George B. Noble of Scossa owns 43 acres in the district. Development work comprises an inclined shaft 150 feet deep and some surface cuts. No lateral work has been done from the Noble shaft. In 1931, when the shaft was sunk, 150 tons of ore were extracted and treated in a custom mill at Rosebud.

Seven Troughs District

The Seven Troughs district is on the west slope of the Seven Troughs Range about 30 miles west of Lovelock. The district was prospected in 1905 but did not attract attention until 1907, when the Mazuma Hills mine was opened. The success of this property and subsequent discoveries by lessees stimulated activity so that in 1908 over 40 companies were organized, many of which were leasing companies. The Mazuma Hills Co. and the Kindergarten Co. each erected a 10-stamp amalgamation-concentration mill in 1908, and in 1909 the Darby Reduction Co. installed a cyanide plant to handle custom ores. The Darby mill was equipped with an automatic Vezin sampler, ten 1,000-pound stamps, two 4- by 17-foot tube mills, a Dorr classifier, amalgamation plates, four agitators, and an Oliver filter. The mill operated until 1918 when it was dismantled.

The Seven Troughs Mining Co., which was formed in 1911, included the Kindergarten and a number of other properties. This company installed a 50-ton cyanide plant in addition to the Kindergarten mill. In 1929 the Seven Troughs Co. erected a 100-ton cyanidation plant. The mill was first started in August 1929 and closed down in June 1931. Subsequently this mill has been operated intermittently by lessees. In March 1936 there was little mining activity in the district.

Table 3 shows the production of the district from 1908 to 1934. A large part of the production has been made by lessees.

A brief description of the geology of the Seven Troughs area is given by Ransome.[15/] The formation is mainly rhyolite cut by basalt dikes. The principal veins follow the basalt dikes. The vein filling consists of sugary quartz and shattered country rock. The values are chiefly in gold with some silver.

The Nevada State Gold Mine Co. (formerly Seven Troughs Mining Co.) owns most of the mineral acreage in the district. Development work comprises a drainage and haulage tunnel 11,900 feet long and extensive underground workings. The property is completely equipped for mining and milling. Equipment includes a power plant, four Diesel engines having a combined rating of 750 hp., a 100-ton cyanidation mill, a machine shop, ore-hauling equipment, drilling equipment, and housing accomodations for the mine and mill crew.

15/ Ransome, Frederick Leslie, Notes on Some Mining Districts in Humboldt County, Nev.: U.S. Geol. Survey Bull. 414, 1909, pp. 22-25.

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TABLE 3. - Silver and gold produced from deep mines, Seven Troughs district, Nevada, 1908-34

Year 1/	Tailings and ore (short tons)	Value of gold	Silver (fine oz.)	Value of silver 2/	Value per ton	Total value 2/
1908	3,582	$180,501	18,533	$9,795	$53.13	$190,296
1909	2,551	128,671	45,012	23,406	59.61	152,077
1910	4,945	184,276	192,996	104,218	58.34	288,494
1911	4,832	348,255	153,079	81,132	88.86	429,387
1912	4,439	295,913	40,775	25,077	72.31	320,990
1913	2,066	81,372	21,788	13,160	45.76	94,532
1914	3,903	295,605	30,089	16,683	80.01	312,288
1915	8,038	465,007	22,734	11,528	59.28	476,535
1916	8,879	159,268	13,048	8,586	18.91	167,854
1917	5,552	81,830	6,554	5,401	15.73	87,231
1918	18,944	45,838	4,038	4,038	2.63	49,876
1919	8,244	28,756	1,638	1,835	3.71	30,591
1920	33	1,618	381	415	61.61	2,033
1921	79	3,437	735	735	52.81	4,172
1922	—	—	—	—	—	2/ 4,088
1930	15,363	220,210	22,686	8,734	14.90	228,944
1931	8,892	121,869	10,497	3,044	14.05	124,913
1932	1,104	20,878	2,968	838	19.67	21,716
1933	920	39,114	1,523	533	43.09	39,647
1934	21,512	228,093	11,098	7,158	10.94	235,251
Total	123,878	2,930,511	600,172	326,316	3/ 26.32	3,260,915

1/ 1923 to 1929, small production.
2/ Includes value of small quantity of base metals.
3/ Figure omitted in computing average value per ton in totals.
4/ Average value per ton.

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In March 1936 Jess Owens and T. H. Williams leased a block of ground opened by the Regan shaft owned by the Nevada State Gold Mines Co. When the writer visited the property a small tonnage of ore had been mined, and the lessees were rehabilitating a small mill owned by Fred Preston of Lovelock in Seven Troughs Canyon to treat the ore. This mill is equipped with a 5- by 7-inch Blake crusher, a 5-foot Huntington mill having a 40-mesh screen, an amalgamating plate 4 feet wide and 10 feet long, and a Wilfley table. Power for milling is furnished by a 15-hp. Fairbanks-Morse gasoline engine. The mill was leased on a royalty basis of 50 cents per ton of ore milled.

Near the camp of Vernon, L. G. Nickerson and his two brothers were working their property of nine unpatented claims, developed by a 400-foot shaft and several adits totaling 4,000 feet in length. The vein ranges from 1 to 5 feet in width and dips 35°. Mining is done by hand methods. In 1935 several carloads of ore had been shipped by the Nickerson brothers to a Salt Lake City smelter. Hauling to Lovelock, 26 miles distant, costs $3.85 per ton on contract.

In 1935 lessees produced about 8,000 tons of ore by screening the mine dumps near the Tyler shaft in Seven Troughs Canyon. A small gasoline shovel was used for this work. After the dump material was screened, the fines were hauled 3 miles to the Seven Troughs cyanidation mill. According to J. H. Caustin, one of the lessees, the cost of loading and trucking was $1.18 and the cost of milling $1.53 per ton. The fines have an average value of about $6 per ton.

Sierra (Dun Glen, Chafey) District

The Sierra, Dun Glen, or Chafey district is at the north end of the East Range 12 miles northeast of Mill City. It was organized in 1863. The town of Dun Glen, settled in 1862, ranked next to Unionville in importance in this part of the State. At one time it had a military post garrisoned by a company of regulars.

Both placer and lode gold were discovered in the sixties by prospectors from Unionville, and a number of mines were opened. The important early mines were the Tallulah, Auld Lang Syne, Munroe, Mayflower, and Auburn. These properties have been worked intermittently up to the present time. In March 1936 the Auld Lang Syne, Auburn, Gold Top, and White Bear mines were being worked on a small scale. Total production from the lode properties in the district has probably exceeded $1,000,000. The greatest activity was from 1862 to 1880. According to Mineral Resources, production from 1908 to 1921, chiefly gold from lode mines, was valued at $314,441.

The placers occur over a large area and include Auburn, Barber, Wright, Rock Hill, and Dun Glen Canyons on the western slope of the range and Spaulding Canyon on the eastern slope. The production of placer gold is said to have had a total value of $4,000,000 and to have come principally from Barber, Wright, Auburn, and Rock Hill Canyons. In all probability the value of the placer production is less than that stated. The bulk of it was produced by Chinese miners.

The Auburn mine near the head of Dun Glen Canyon comprises five patented and six unpatented claims owned by Mrs. C. H. Rowland of Lovelock. In the eighties a 10-stamp amalgamation-concentration mill was operated on the property for several years. Production from the mine is reported to have been worth $250,000. The mine

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has been developed by six adits; total workings comprise about 3,500 feet. Several years ago a small mill was erected on the property. The mill equipment consists of a jaw crusher, an Ellis ball mill, a 2- by 7-foot amalgamating plate, and a small concentrating table. The mill is still intact. Water for milling is available from a spring below the mine.

The formation consists of limestone, schist, and rhyolite. Numerous small quartz veins occur in the limestone and schist. The values are in gold, silver, and lead.

In March 1936 William Kline and partner were working the property under lease on a royalty of 15 percent of the net smelter returns. Mining was done by "chloriding" small stringers. When the mine was visited Kline and partner had produced, in about 3 months, 16 tons of shipping ore that was reported to average better than $100 per ton.

The Auld Lang Syne mine in Dun Glen Canyon comprises a group of five small patented claims owned by Moses Reinhardt of Winnemucca. These claims were among the first to be patented in Humboldt County. The mine is developed by several tunnels, and the total length of workings is roughly 2,000 feet. The property is reported to have produced ore worth $200,000. In the early days a mill was erected in Dun Glen Canyon below the mine. Mill tailings total about 6,000 tons, which are said to have been treated by cyanidation some years ago. A mill was erected in 1931 on the Auld Lang Syne property. Mill equipment consists of an 8- by 10-inch Dodge jaw crusher, a Challenge feeder, a 5-foot Huntington mill with 40-mesh screen, a 4- by 10-foot amalgamating plate, and two Wilfley tables. Power for milling is supplied by a 25-hp. Fairbanks-Morse semi-Diesel type-Y engine. The capacity of the mill is 10 tons per day. F. E. Braito and associates who are operating the Gold Top property are leasing the mill. The royalty for milling is 50 cents per ton.

The Auld Lang Syne vein zone as exposed where the stopes come to the surface, is about 100 feet wide and contains four parallel veins; the average width of each vein is 2½ feet, and they dip at an angle of 45°. The vein material is hard white quartz in silicified andesite, and values are in gold and silver. In 1935 the four veins exposed in the Auld Lang Syne glory hole were sampled by F. E. Braito. A 22-ton representative sample was milled, and $3.90 per ton was recovered by amalgamation. The tailings averaged $2.65 per ton. According to Braito the best ore is near the surface; below a depth of 75 feet the values decrease.

In March 1936 the mine was under lease to H. M. Gilbert, who was prospecting with three men.

The property of the White Bear Mining Co. comprises 12 claims in Munroe Canyon 1½ miles east of Dun Glen. The company is owned by stockholders of Altoona, Pa. In 1908 E. S. Chafey and associates acquired the property and equipped it with a 30-ton mill, which was destroyed by fire in 1929. From 1908 to 1910 the property is said to have produced ore worth $100,000, chiefly in gold. In 1932 the White Bear Mining Co. started to erect a mill, but owing to financial difficulties the mill was not completed until March 1935. After the mill had operated several weeks in 1935 it was shut down.

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The mine is opened by four main tunnels from which drifts have been driven on the vein. Total underground workings comprise 5,000 feet. Mining equipment includes a four-drill Chicago Pneumatic compressor driven by a 40-hp. gasoline engine and a one-drill compressor driven by a 15-hp. Fairbanks-Morse engine. Steel is hand-sharpened.

Mill equipment consists of a Blake crusher (size 10 by 12 inches), two sets of rolls (size 16 by 16 inches) arranged in series with a vibratory screen between them, a Challenge feeder, a Marcy 43 ball mill in closed circuit with a Dorr Simplex classifier, two amalgamating plates (4 feet wide and 18 feet long), and three Wilfley tables. The capacity of the mill is 30 tons per day. Power for milling is supplied by two Muncie oil engines of 40 and 70 hp., and water is obtained from a tunnel above the mill.

The formation is schist, slate, rhyolite, and tuffs cut by diabase dikes. The vein is persistent and is exposed on the surface and in underground workings for 4,000 feet. The width of the vein ranges from 3 to 8 feet, and it dips at an angle of 60°. Where stoping has been done the average width of the vein is 4 feet. Vein filling is solid quartz carrying gold and a little silver. Small quantities of pyrite, sphalerite, and galena are present. In March 1936 four men were doing exploratory work in the mine.

The Gold Top group of five unpatented claims owned by Braito and associate is in the left fork of Barber Canyon. Development work on the property comprises an adit 280 feet long and other workings and totals 500 feet. Mining is done by hand methods. The vein is 3 inches to 3 feet wide: Values are chiefly in gold. Ore is trucked 13 miles to the Auld Lang Syne mill at $2.00 per ton on contract. In 1935, 562 tons of ore were milled that averaged $24 per ton in value.

Recent placer activity in the Sierra district has been confined to Dun Glen, Barber, and Spaulding Canyon.

The Dun Glen placer has a length of about 4½ miles, and an average width of 200 feet. In past years numerous shafts have been sunk in the canyon to test the gravel. The shafts are 18 to 40 feet deep and reach bedrock. It is reported that 5 to 6 feet of the gravel lying above the bedrock carries $2 to $3 in gold per cubic yard at the former price of $20.67 per ounce. Drift mining of the gravels has been hampered by a large flow of water encountered near bedrock.

In 1934 sluicing was done on a small scale in Barber Canyon by Barney Sorenson of Salt Lake City. The placer ground was worked by first stripping the overburden to a depth of 12 feet with a caterpillar tractor and scraper and then hydraulicking the gravel near bedrock. A canvas hose and fire nozzle were employed to sluice the gravel to the washing plant. The washing plant consisted of a combination disintegrating and screening trommel (10 feet long and 4 feet in diameter) and a sluice box 36 feet long equipped with Hungarian riffles. Water for placering was pumped from a well sunk in the canyon.

In 1935 the hydraulic equipment was replaced by a patented placer machine called a "desert sluice", invented by G. W. Rathjens, chief engineer of the U. S. Smelting & Refining Co. A 1-cubic yard power shovel was used for mining the gravel. Operations were suspended after a short time.

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Barber Canyon is 2 miles long and averages 300 feet in width. The average depth to bedrock is 30 feet. The best values are on bedrock and on benches at the sides of the canyon. The gold is coarse and averages 875 fine. The average value of the ground, including the low-grade surface material, is reported to be 28 cents per cubic yard.

In recent years several groups of men were placering on a small scale for 2 miles along Spaulding Canyon. These groups are reported to have made wages.

Spring Valley District

The Spring Valley district is on the east slope of the Humboldt Range 14 miles east of Oreana via the Limerick Canyon road, which crosses the Humboldt Range. It can also be reached by automobile road from Mill City, 28 miles north.

The Eagle mine, better known as the Bonanza King, is the only important lode mine in the district. It was located in 1868. A 15-stamp mill erected on the property in 1873 treated about 7,000 tons of ore, judging from the old tailings dump. These tailings are reported to average $4 per ton in gold and silver at current metal prices. The property was operated by the Bonanza King Mining Co. several years prior to 1910. It is owned by M. M. McKeever of Boston. The property consists of one patented claim and five unpatented claims.

In 1934 the property was under bond and lease to F. R. McDonald who had charge of the property in 1910. When it was visited McDonald was employed in rehabilitating the mine. A 500-cubic foot compressor, driven by a four-cylinder Hercules engine, and a 15-hp. Fairbanks-Morse geared hoist had been installed. The mine is opened by a vertical shaft with levels at 100-, 225-, and 300-foot elevations. According to McDonald 4,600 tons of ore are blocked out in the mine.

The Bonanza King vein is in a rhyolite formation. The vein filling is quartz stained in places by copper carbonates. The vein ranges in width from 2½ to 5 feet and dips nearly vertically. The ore minerals are gold, galena, pyrite, sphalerite, and tetrehedrite. A carload of ore shipped to the American Smelting & Refining Co. of Salt Lake City in 1908 contained 2.65 ounces of gold and 8.32 ounces of silver per ton, 2 percent iron, 9 percent insoluble, considerable lead, a little zinc and sulphur, and a trace of copper.

Spring Valley Gulch 2 miles southeast of the Bonanza King mine contains a cinnabar deposit owned by the Cinnabar King Mining Co. A Newhall furnace, 20 feet long and 2½ feet in diameter, and a metal-pipe condensing system were built in 1931, but the plant closed down the same year owing to the low price of mercury. An aerial gravity tram several hundred feet long connects the workings with the mill. The cinnabar occurs in limestone.

Placer mining began in Spring Valley in 1881. The output of the Spring Valley, American Canyon, and Dry Gulch placer areas was large. Ransome[16] states:

> The placers were first worked by Americans, who are reported to have taken out gold to the value of $1,000,000. The ground, however, soon passed into the possession of the Chinese, who formed a considerable settlement in

16/ Ransome, F.L., Notes on Some Mining Districts in Humboldt County, Nev.: U.S. Geol. Survey Bull. 414, 1909, p. 12.

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American Canyon and mined the gravels with skill and assiduity by drifting from countless narrow shafts ranging from 40 to 85 feet deep. How much gold they obtained is unknown, but some estimates, doubtless much exaggerated, place the total at about $10,000,000.

The hundreds of shallow shafts and piles of gravel and tailings are ample proof of former activity. The Americans leased the ground to Chinese placer operators on a royalty basis, and the ground was subleased to individual Chinese in blocks 20 feet square. Locke states:17/

> Each block of 400 square feet produced an average of $1,500 to $3,000 in gold dust and nuggets.

In 1910 the Federal Mines Co. installed a dredge to work the lower part of Spring Valley Canyon. According to the old records of the company the output of the dredge from October 15, 1912, to January 17, 1914, was 58,494 cubic yards of gravel valued at $10,902.43 or $0.186 per cubic yard.

Dredging was hampered by the scarcity of water, which was piped and flumed from Indian Creek 5 miles north. It was difficult to keep the dredge afloat because of the old underground workings which threatened to drain the dredge pond.

The gold occurs from the surface down in a series of gravel layers underlain by seams of clay. The alluvium contains many boulders. The gold is coarse, and it averages 700 fine.

Twelve hundred acres of placer ground in Spring Valley Canyon are owned by J. B. O'Marr, A. E. Evans, and H. T. Brink. In March 1936 Los Angeles interests were negotiating for an option to sample the property. Placer ground in Dry Gulch owned by W. A. Wilson and others was also being investigated by the same interests.

In recent years there has been some small-scale placer mining in Spring Valley, American Canyon, and Dry Gulch. At the head of Limerick Canyon, west of the divide separating this canyon and Spring Valley, placer deposits were worked in former years by small-scale methods. In 1931 the Limerick Canyon Mining Co. erected a small placer plant on the Puett property. It is reported that operations were unsuccessful because water was scarce, and the plant operated only a short time.

Here the depth of the placer gravel is 2 to 38 feet and averages 11 feet. The alluvium contains chiefly schist and no large boulders. The best values are concentrated on the schist bedrock. Most of the gold is the size of mustard seeds, and it averages 850 fine.

In March 1936 the Puett and Walker placer properties in Limerick Basin were under option to San Francisco interests, and the ground was being sampled by six men. A 5-cubic yard concrete mixer was used for this work. A little water is available at McCarthy Springs, 1½ miles below the placer ground.

17/ Locke, Ernest G., Reawakening of an Old Placer Camp; Min. and Sci. Press, vol. 107, 1913, p. 373.

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Star District

The Star district is near Star Creek Canyon on the east slope of the north end of the Humboldt Range 6 miles north of Unionville and 12 miles south of Mill City, a station on the Southern Pacific Railroad. The district was organized in 1861. In 1867 it was the scene of one of the wildest mining booms in the State after the discovery of rich silver ore in the Sheba vein. Star City became a town of 1,000 inhabitants and boasted two hotels, a Wells-Fargo Express office, a special telegraph line to Virginia City, and daily United States mail service. By 1868 the boom had collapsed. So sudden was the decline that in 1868 a writer of the period quaintly remarked, "the daily mail, the express office, telegraph office are all in operation yet, but the entire population consists of a single family, the head of which is mayor, constable, postmaster, express agent, telegraph operator, and I believe the sole unanimous voter!"

The principal mines were the Sheba and DeSoto, the outputs of which have fluctuated widely. Production from the district is reported to have been several million dollars. The mines have been idle for many years.

The rich silver ore occurred in lenses in limestone and sandstone. The sulphide ore contains stibnite, sphalerite, galena, fahlerz (tetrahedrite and tennantite), and pyrite in a gangue of white quartz. It is said that the first-class ore mined in the Sheba property was worth $300 to $500 per ton. The second-class ore was worth $60 to $70 per ton.

The base character of the ores rendered their reduction difficult by the processes in use at the time. Amalgamation methods of treatment which were applied to the Comstock ores in the early days were tried, but these did not prove very successful. In 1873 a Krom concentrator was erected to treat the ores. The Krom process employed dry concentration. Power for mining and milling in this area was partly generated by water wheels. Star Creek drains a considerable area, and at certain times of the year its flow of water is quite large.

One mile below the Sheba mine in Star Creek Canyon is a quartz vein that carries stibnite. Another deposit of stibnite occurs in Bloody Canyon several miles south of Star Creek Canyon. Antimony ores have been produced in a desultory manner for many years. Antimony was last produced in the district in 1917 and 1918.

Trinity District

The Trinity district is in Trinity Canyon on the east flank of the Trinity Range 11 miles north of Lovelock by unimproved automobile road. It was discovered in 1859 by George Lovelock. The principal property is the Evening Star, which produced considerable rich ore in the early days. Some ore was hauled to Sacramento by ox team and shipped to Swansea, Wales, for treatment. No authentic figures are available on past production. A small mill built at the Evening Star mine in the early days operated for several years. Lessees worked the property intermittently from 1914 to 1916 and shipped some ore. In 1934 the Evening Star patented claim was purchased by Clayton Mendham at a tax sale. The mine was reopened by Mendham and associates, and several lots of ore totaling 13 tons and averaging $90 per ton net were shipped to smelters in 1935. In the fall of 1935 a small Gibson mill was installed, and about 25 tons of ore were treated. The ore

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milled is reported to have averaged about $50 per ton. Mining was done by hand methods.

The property is developed by an inclined shaft several hundred feet deep and several adits. Workings total about 1,500 feet. Ore occurs in two parallel veins in granite. Values are in silver and gold. The gold is free and associated with iron oxide. A little copper and zinc are present in some of the ore. The gangue is hard, laminated quartz. The width of the veins ranges from several inches to 3½ feet, averaging about 1½ feet, and the veins dip about 55°.

The mill equipment consists of a 5-ton Gibson mill, a 1- by 5-foot silver-plated amalgamating plate, and a small concentrating table. The capacity of the plant is reported to be only 1/2 ton of ore in 8 hours. Power for milling and pumping is furnished by 7-hp. Satley gasoline engine. Water for milling is pumped from a well 24 feet deep sunk in the canyon a short distance above the mill. Amalgamation and table concentration is reported to extract about 60 percent of the ore. The tailings from the mill were treated in a small, experimental, cyanide leaching plant consisting of four tanks, 4 feet high and 5 feet in diameter, of which two are used for leaching, one for barren solution, and one for stock solution. Solutions are circulated by hand pumping. Zinc shavings are used to precipitate the gold and silver. The total cost of milling equipment has been about $2,000.

A small lot of ore shipped to the United States Smelting Co. on June 29, 1935, gave the following information:

Metal quotation:

Ag - per oz.	$0.77
Au - do.	34.9125

Settlement assay:

Au - oz.	.90
Ag - do.	43.0
Cu - percent	.2
Insoluble - percent	90.4
Fe - percent	3.9
Zn - do.	.2

Metal value:

Au, 100 percent at 31.8183	28.64
Ag, 100 percent at 0.77	33.11
	61.75
Less 5 percent, value of Ag.	1.66
	60.09
Less working charge	7.50
	52.59

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Total weight - lb.....	4,002		
Sacks (29) - - do.....	41		
	3,961		
Moisture 1.0 percent - lb.....	39		
	3,922		
tons....	1,961 at $52.59 per ton ...		$103.13
Freight	$18.47		
Freight surtax, 10 percent.....	1.85		
Assay charges and handling.....	7.50		
Sacks returned	.55		
	28.37		28.37
Net payment			74.76

When the writer visited the property a Sullivan 150-cubic foot portable compressor had been purchased, and preparations were under way to develop the property on a scale larger than was possible by hand methods.

Several other groups of claims above and below the Evening Star property are held by various owners, but these claims are still in the prospecting stage.

Unionville (Buena Vista) District

The Unionville or Buena Vista district is on the east slope of the Humboldt Range 20 miles south of Mill City, the nearest railroad point. The district was organized in 1861 and the town of Unionville founded. This town became the center of mining activity and was the county seat of Humboldt County up to 1883.

Silver-bearing lodes were discovered in this area shortly after the first developments on the Comstock. The most prominent mine was the Arizona, which was discovered in 1862. The mine was purchased by John C. Fall and company in 1866. The property was shut down in 1880 but was subsequently worked at various times. Other important mines that were worked in the early days are the Henning (Wheeler) and Pfluger (Manoa). In the early seventies three 10-stamp mills were treating the lower-grade ores in the district; the higher-grade ores were hauled by team to Sacramento and shipped in sailing vessels to Swansea, Wales. The stamp mills employed the Washoe pan-amalgamation process in which the ores were crushed wet and amalgamated in pans without roasting. The ores in this area were not so amenable to pan amalgamation as those in the Comstock, therefore the yield from the first treatment was little more than 50 percent of the assay value. The tailings were reworked by the same process after standing a while, to recover additional values. Table 4 presents interesting data on mining and milling costs at Unionville in 1869.[18/]

18/ Raymond, R. W., Mines and Mining West of the Rocky Mountains: 1869, p. 190.

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TABLE 4. - Mining and milling costs at Unionville in 1869

Wages of first class miners	$4 a day or $3 and board.
Wages of second class miners	Not known here.
Wages of surface laborers	$3 to $3.50 per day.
Cost of lumber per thousand	$50 to $60.
Cost of mining timber	$.25 to $2 a piece.
Cost of common powder	$5 to $6.
Cost of giant power	None used.
Cost of quicksilver	$0.65 to $0.70 (per lb.)
Cost of freight from base of supplies	$60 per ton.
Cost of fuel	$10 to $12 per cord of cedar wood.
Average mining cost per ton	$12 to $15.
Average pulp assay of ore	$60 to $100.
Average yield of ore	$30 to $60.

Indian laborers, employed about the mine, get from $1.50 to $2.50. Very little lumber is used in the mines. Timber is used to support loose parts of the rock and mostly for support in stoping. The mines being yet in their infancy, much deadwork has been done, increasing the average cost of mining per ton.

Complete statistics of production from the district are not available. The total production doubtless exceeds $2,000,000, most of which was derived from the Arizona mine. According to Whitehill[19] the yield of bullion from the Arizona mine from 1871 to 1877 was as follows:

Year	Bullion production	Year	Bullion production
1871	$339,808	1875	$78,944
1872	326,531	1876	60,727
1873	246,621	1877	78,877
1874	172,731	Total	1,304,239

The Henning mine is reported to have produced ore worth $125,000. The last revival of activity in the district was from 1921 to 1924 when the Arizona, Henning, and other mines were worked. According to Mineral Resources the production for the period is as follows:

Year	Tons ore and tailings	Total value	Value per ton
1921	3,271	$69,273	$21.18
1922	2,274	23,393	10.29
1923	8,089	------	-----
1924	3,714	12,946	3.49

The ores were treated in several small flotation or cyanidation mills. In recent years there has been little lode mining activity near Unionville.

The Arizona deposit is a flat vein in limestone near the top of a hill under which it is practically continuous. The old stopes have an area of about 18 acres. The width of the vein ranges from 10 inches to 5 feet, averaging 2½ feet. The

19/ Whitehill, H.R., Biennial Report of the State Mineralogist of the State of Nevada for the years 1877-78, p.64.

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gangue consists of banded quartz, and the ore minerals are pyrite, galena, sphalerite, tetahedrite, argentite, and sulphantimonite. Ransome[20] comments on the applicability of our mining laws to deposits of this form as follows:

> It is a fact of some interest that deposits of this character were known and worked in Nevada at the time when our mining laws of 1866 and 1872, apparently so little applicable to them, were passed. The statement made by Shamel[21] that it is probable that at the date of the passage of the statute of 1872 no instance was known of a vein which assumed a horizontal or even an approximately horizontal direction, is obviously incorrect.

The Henning mine 1 mile south of the Arizona mine is also a flat vein in limestone. The Pfluger mine is in Cottonwood Canyon 3 miles south of Unionville. The ore is a lead-silver ore which carries a little copper and gold. The property comprises 13 patented claims owned by the Pfluger Estate of San Francisco, Calif.

In Jackson Canyon an antimony vein has been worked in former years. During the World War the Magnolia Metals Co. produced some antimony by working the mine and dumps. The property is called the Jackson mine and comprises five unpatented claims owned by William Bradley of Imlay. Development work totals 1,000 feet of tunnels and drifts. The width of the vein ranges from 6 inches to 8 feet and averages 2½ feet, and it dips about 75°. Bunches of stibnite occur in quartz. The formation is rhyolite.

In March 1936 the only activity in the district was some small-scale placering done by Sidney Thornton in Congress Canyon, on the north fork of Buena Vista Canyon. Gravel is drift-mined and sluiced. The depth of the gravel averages 12 feet. Water for small-scale sluicing is available in Congress Canyon.

Velvet District.

The Velvet district is on the west slope of the Trinity Range 24 miles by automobile road a little north of west from Lovelock. The last 4 miles of the road from Lowry Wells to the district are in very poor condition. Most of the prospecting was done from 1915 to 1919. It is said that a lens of rich ore that was produced was worth about $20,000. This ore which was shipped constituted the principal production from the district. When the district was visited there was no activity.

The ore minerals in the district are gold and a subordinate quantity of silver. The principal formation is altered rhyolite. The gold occurs mainly in the free state along iron-stained joints and crevices in the rhyolite. Very little vein quartz was observed on the dumps.

In 1935 the Houskin Bros., Charles and Archie, of Lovelock, installed a small amalgamation mill at Juniper Mountain 14 miles west of the district where water is available. The mill has a capacity of 8 tons of ore in 12 hours. In 1935 about 50 tons of ore were taken from a tunnel on the Houskin group of three unpatented claims and treated in this mill, and bullion worth about $900 was recovered. This

20/ Ransome, F. L., Notes on Some Mining Districts in Humboldt County, Nev.: U.S. Geol. Survey Bull. 414, 1909, p. 39.

21/ Shamel, --, Mining, Mineral, and Geological Law: New York, 1907, p. 233.

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is the only mill ever erected in the Velvet district to treat ore. The Houskin ground has been prospected by three shallow shafts and several tunnels, or a total of 700 feet of workings.

Another group of claims is held by George Land and Fred Ringle of Lovelock. This group comprises nine unpatented claims with a total of 500 feet of exploratory workings.

Some prospecting has been done in former years for fire opals in a volcanic formation where the road to Velvet crosses the summit of the Trinity Range. The opals are said to have flaws and to deteriorate rapidly when exposed to the air. As far as the writer is aware no good gem opals have been found.

Diatomaceous earth of good quality also occurs in this area, but it is so far from railroad transportation as to preclude its exploitation on a large scale to compete with other sources of supply at present. Some diatomaceous earth was shipped from here in 1923.

Washiki District

The Washiki district is on the west slope of the Sonoma Range near Clear Creek 25 miles by automobile road a little east of south from Winnemucca. The mineralized area is partly in Humboldt County but mostly in Pershing County. The district was discovered about 1906, and C. F. Carpenter was one of the original locaters and perhaps the original discoverer. The total production is reported to be valued at not more than $15,000, nearly all of which was derived from shipping ore. In 1915 James Wilson erected a two-stamp, Tonopah-type, amalgamation mill that operated only a short time. A Tonopah stamp mill is similar to an ordinary stamp mill except that the stamps do not fall freely but are controlled by springs to attain more drops per minute.

Bunches of ore occur in narrow quartz veins mainly in granite. Values are chiefly in gold with some silver and lead. The best values are said to be associated with the lead. The average dip of the veins is 55°. Development work consists of a number of scattered prospecting shafts, of which the deepest is 90 feet, and a number of open-cuts. Total workings comprise about 1,000 feet. All mining has been by hand.

In 1934 R. E. Gayer, leasing three unpatented claims owned by Frank O'Leary of Winnemucca, shipped 2 carloads of ore. The royalty was 10 percent of the net smelter returns. Returns on one of these carloads of ore shipped to the smelter of the U. S. Smelting, Refining & Mining Co. at Salt Lake City on July 12, 1934 furnished the following data:

Metal quotation:	
Ag - per oz.....	$0.64125
Assay values:	
Au - oz.....	0.38
Ag - do.....	2.5
Insoluble - percent	73.7
Fe - percent.....	9.6
S - do.	1.0

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Metal payments:

Au, 100 percent at $31.8183	$12.09
Ag, 100 percent at $ 0.64125	1.60
	13.69
Less 0.5 oz. Ag	.32
	13.37
Less treatment charge	3.70
	9.67

Net weight - pounds	80,420	
Less 6.7 percent moisture - pounds	5,388	
Dry weight - pounds	75,032	
tons	37,516	
37.516 tons at $9.67 per ton		$362.78
Freight 40.21 tons at $3.20 per ton		128.67
Net payment		234.11

In 1933 and 1934 L. E. Case of Winnemucca working on his property earned about $2,500 from 30 tons of shipping ore and little bullion recovered from high-grade ore, ground and amalgamated by hand. According to Case the shipping ore averaged about 2½ ounces of gold and 15 ounces of silver per ton and 8 percent lead.

Wild Horse District

The Wild Horse district is in the Humboldt Range 37 miles by road southeast of Lovelock. A shorter route is 21 miles from Lovelock, but the road is in poor condition. The district was discovered by William Pettit about 30 years ago. The deepest shaft in the area is 35 feet, and development work totals about 200 feet. A small lot of antimony ore was shipped about 1918 by H. E. Loufek, of Reno. This is the only record of production.

At present, the Green Bros., Averill and Frank, of Lovelock, who are working their property consisting of three unpatented claims, are the only active operators in the district. They have worked intermittently for the past 3 years. Mining (by hand methods) is confined to a vein 4 feet wide on the surface. The vein dips about 45°. The formation is monzonite. The ore carries silver, antimony, and lead. When the writer visited the mine, the Green Bros. had 30 tons of ore ready to ship that would average about $60 per ton. Water is available from several nearby springs.

Willard (Loring) District

The Willard or Loring district is at the west end of Coal Canyon in the Humboldt Range 3 miles east of Kodak and 9 miles northeast of Lovelock. The district was discovered in 1915 by G. H. Downing, and a small boom ensued. The Sheepherder mine has been the principal property. Shortly after its discovery lessees built a 30-ton Gibson mill at Kodak to treat the ore, but the mill ran only a short time. In 1915 the Honey Bee and Sheepherder properties shipped ore to smelters. The value of production from the district, chiefly in gold, has been only a few thousand dollars.

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In 1920 eight claims owned by William Opperman and John Fant of Lovelock were optioned to New York interests which organized the Honey Bee Mining Co. Some development work was done, but no ore was produced, and after a short time the property reverted to the original owner. Development work on these claims consists of a 700-foot tunnel, a 200-foot shaft, and scattered workings, or a total of about 1,300 feet. From 1916 to 1918 five carloads of ore averaging $23 per ton are reported to have been produced.

The formation in the district is mainly shale and limestone intruded by rhyolite dikes. The sediments are considerably folded, fractured, and faulted. The ore occurs in irregular quartz veins heavily stained with iron oxide and is free milling. Some silver also is present.

In March 1936 the only property active was the Red Rock group of five unpatented claims owned by C. Lee and H. Burbridge of Lovelock. In 1935 a small lot of ore was shipped from a vein exposed at the surface for about 100 feet. Smelter returns on this shipment, made January 28, 1935, to the U. S. Smelting, Refining & Mining Co., furnished the following information:

Metal quotation:		
Ag - per ounce		$0.64125
Au - do.		34.9125
Settlement assay:		
Au - per ton		.575
Ag - oz		3.4
Insoluble - percent		91.4
Fe - percent		1.8
S - do.		.3
Metal value:		
Au, 100 percent at 31.8183		$18.30
Ag, 100 percent at 0.64125		2.18
Total metal value		$20.48
Less 0.5 oz. silver value		.32
Gross value		20.16
Less working charge		4.90
Net value per ton		15.26
Total wet weight - lb	24,160	
Sacks (228) lb	250	
Net wet weight - lb	23,910	
Less 2 percent moisture - lb	478	
Dry weight - lb	23,432	
tons	11.716	
11.716 tons at $15.26 per ton		178.79
Freight advanced, $5.98 per ton	72.24	
Ore sacks (100)	12.00	
Freight and sacks returned	1.19	
	85.43	85.43
Net payment		93.36

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On the south side of Coal Canyon there is a deposit of bentonite-type clay. Three 20-acre placer claims covering the main part of the deposit are held by Stefan Herzog of Lovelock. The bentonite outcrops on the north side of a small ravine for several hundred yards. The deposit has been prospected by four open-cuts driven into the side of the hill, which exposed depths of 8 to 20 feet of clay. The bentonite is considerably fractured and is stained yellow in places. Occasional seams of gypsum 3/4 inch thick traverse the deposit. The nearest railroad siding is at Kodak 4 miles west.

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